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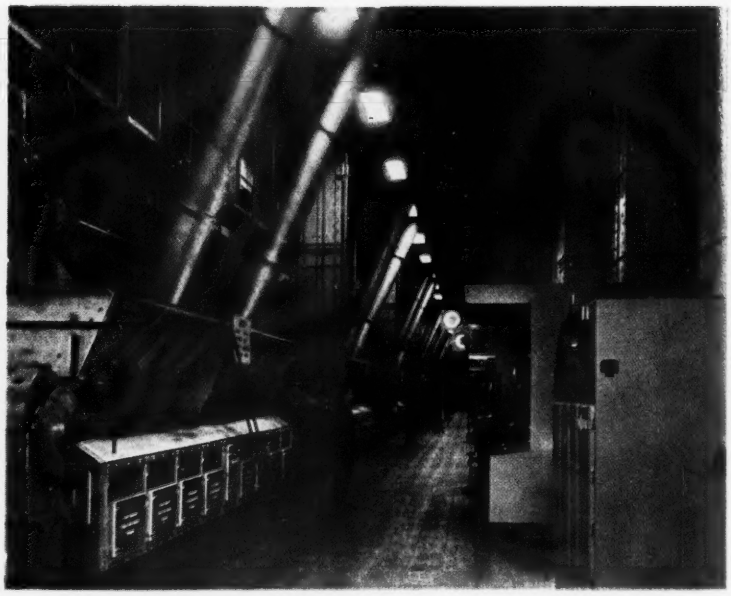

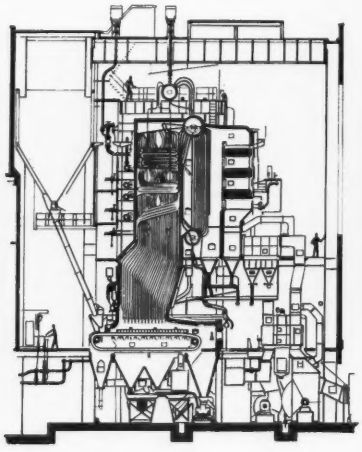

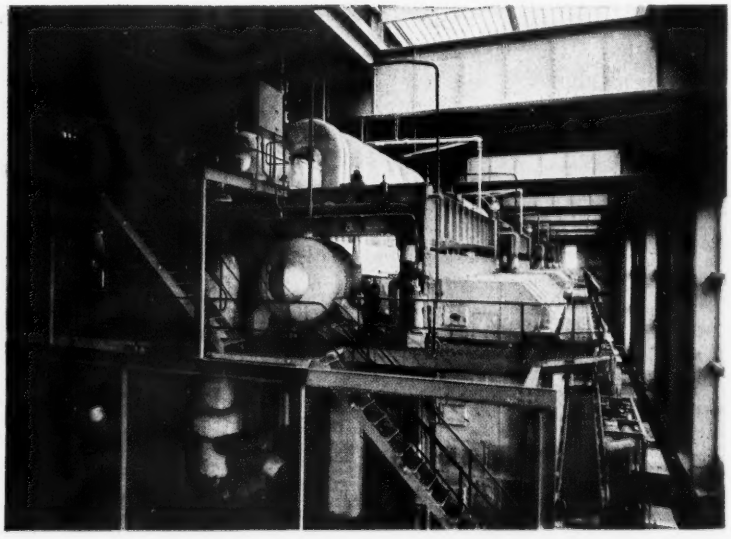

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ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E.
General Editor: J. H. COSENS
Technical Editor: P. W. TUCKER, M.I.E.E.

4 MAY 1956

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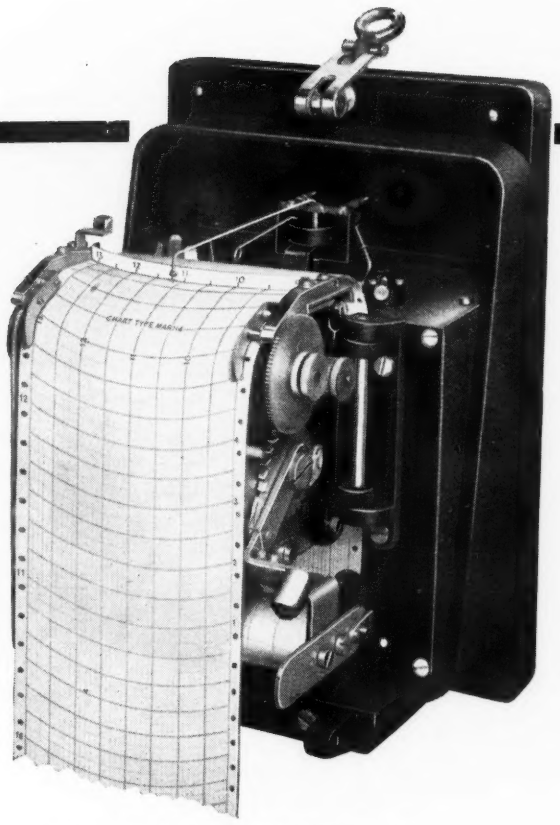

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ELECTRICAL REVIEW

4 May 1956 Vol. 158 No. 18 Established 1872

Norway Shows the Way

IN this issue we publish the first of three consecutive articles describing the integrated iron and steel works recently brought into service in the far north of Norway. These are of considerable interest to electrical engineers because of the very high degree of electrification achieved at every stage of production: they are of interest to all engineers because of the problems of construction and operation posed by the continuing intensely severe weather conditions; and they are of interest to everyone in the context of international development in seemingly barren areas of the world.

The most unusual feature, by British standards, is the complete dependence of pig-iron production on the electric smelting furnaces, nearly 60,000 kW of power being taken by the three of these at present installed. About 3,000 kWh is used in the works for every ton of finished steel products, and about 1,000 lb of coke, mainly to provide for the chemical reduction of the ore. Since coal is the only material for iron production not present in Norway, the minimising of the need for it was clearly essential and a major hydro-electric station constructed nearby provides the power which largely replaces coal. The preponderance of electrical power has its accompaniment of vastly cleaner working conditions and surroundings.

To-day the tendency in most places is for coal output to fall, and hand in hand with this fall is an increase in demand for iron and steel products, as living standards rise. The industry is a voracious consumer of coal—about 27 million tons being used in 1954 for coke ovens associated with it in this country. Methods of economising our natural carbon resources and using them as chemicals, instead of as convenient sources of heat, are vital to our future development and it seems probable that pig-iron production by electrical power will have to be considered in this country. The quality of coke required for the electric pig-iron furnaces is not so important as with the conventional blast furnace and this fact must be set beside the tendency for the quality of mined coal to deteriorate as mechanisation increases and the poorer seams have to be exploited.

Electricity production, on the other hand, is more and more using the lowest quality coal which other industries could not easily absorb; and the advent of nuclear power to supplement " fossil " fuels lends point to our belief that the coming quarter of a century will see major changes in the iron industry as in all the other principal coal consuming industries.

The example of a development like that at Mo i Rana may give confidence in future exploitation of the minerals believed to exist extensively in the Antarctic regions

and of those in less frigid but similarly remote areas such as parts of Africa, where ore deposits and water power are sometimes available in reasonable proximity to one another but are not near any coal, which thus would normally necessitate heavy transport demands.

A GOOD SHOW

Those who have visited the London Section of the British Industries Fair, which closes to-day, are agreed that the electrical stands were first-class. Exhibitors went to great lengths to make their displays worthy of Great Britain's only export exhibition which makes it the greater pity that this has been the last B.I.F. in London. There has also been general agreement, particularly among the exhibitors, that the ill-timed announcement by the President of the Board of Trade has had a damaging effect upon attendance.

Final figures are not yet available but most of the people on the stands have told us that the fall in the number of potential customers has been very noticeable. Generally speaking, however, the firms displaying the smaller equipment, especially domestic appliances, seem to be satisfied with the amount of business done. Those concerned with heavy engineering are not so happy but naturally in their case orders are rarely placed on the spot and they can only hope to make contacts which may be profitable later on.

The Electrical Exhibitors' Committee have been obtaining stand-holders' views on the future shows and we hope to be able to present these in a subsequent issue.

EXTRAVAGANT CLAIMS

Any benefits to the home or overseas customer resulting from automation in the engineering industries would be negatived by the adoption of the ideas put forward at last week's annual conference of the Amalgamated Engineering Union. In the first place the Union appears to require its consent to be obtained before any automation system is introduced. Secondly any displaced workers are to be kept on by their employers until other suitable work can be found for them, presumably in the same factory, which destroys any idea of mobility—the transfer of people to under-manned works.

Other claims which are to go forward from the conference are also calculated to aggravate inflation. They include a demand for a substantial increase in wages (the last one was made about two months ago) and the reduction of the working week from 44 hours to 40. Delegates warned employers that there would be trouble if these demands were resisted, although the Union's executive appeared to be unhappy about some of them. It looks as though, once again, the industry is to be distracted by prolonged discussions during the next few months.

DOMESTIC SURVEY

When the tenant of domestic premises asks for a supply of electricity he is required to state the maximum power wanted. This may be ascertained by eliciting from him a list of appliances he proposes to use; the service arrangements naturally provide for rather more than the original requirement. By law the consumer must not exceed his stated requirement without giving the supply authority due notice, but it is rarely that this rule is observed. Consequently the supply authority seldom knows what equipment a consumer has although for a number of reasons it would be well to have that knowledge.

A partial sample survey of domestic consumers was undertaken in 1946 by the Electrical Research Association. This, though incomplete, was useful for various purposes. Nationalisation of electricity supply made a more thorough survey feasible and this was made by the Utilisation Research Committee of the C.E.A. and Electricity Boards last year. The results are summarised in this issue. As a basis one consumer per thousand was visited and ready co-operation was obtained. The report shows that an enormous scope for electrical development remains; for instance, only about a quarter of the consumers have electric cookers and only 20 per cent have water heaters. It will add to the usefulness of the survey when the actual consumption for certain services, and other figures, are published in the more comprehensive report which is promised.

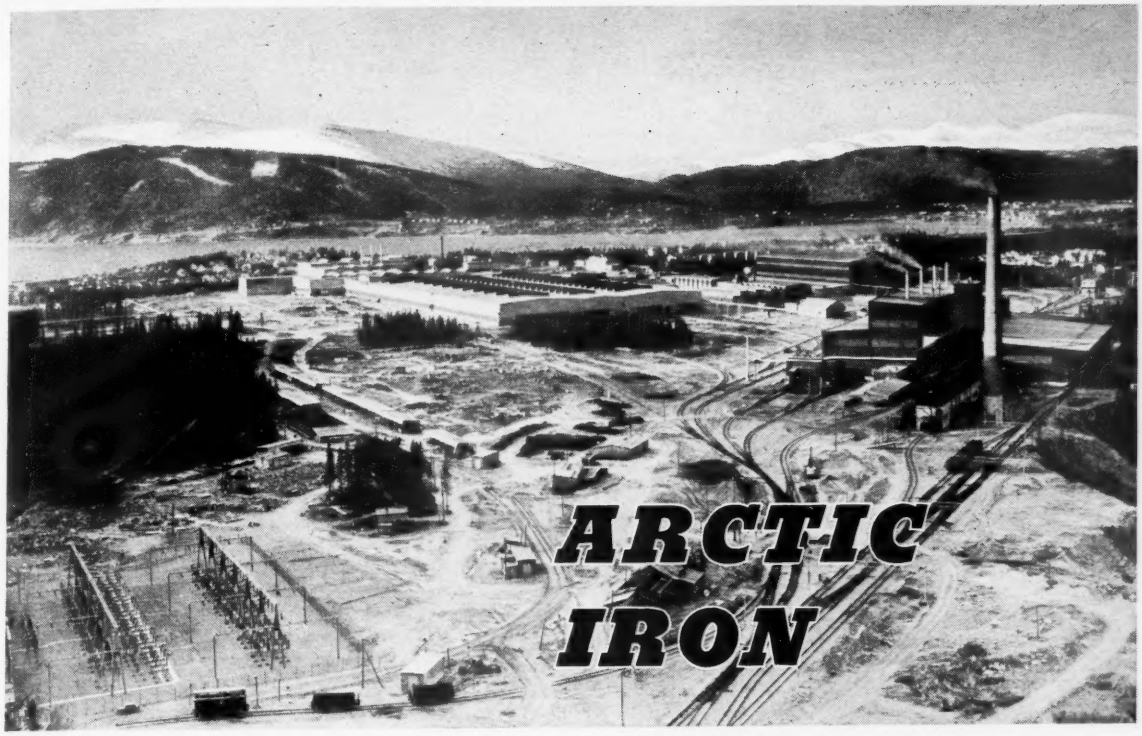
FUTURE COAL SUPPLIES

We do not think it is quite fair to stigmatise the new report of the National Coal Board " Investing in Coal " as an attempt to justify the failure of the forecast of the " Plan for Coal," published five years ago, as appears to have been done in some quarters. Many millions of pounds have been spent since " Plan for Coal " was launched, but instead of the production of 240 million tons of coal a year in 1961 to 1965 as was forecast, the revised plan gives the figures of 228 million tons in 1960 and 240 million tons in 1965. It seems that the greater part of the expenditure has so far been devoted to sinking shafts and boring tunnels which are not yet contributing to production. It was a colossal undertaking to launch nearly 200 major colliery schemes and nothing like it had ever been attempted before. We therefore feel that judgment should be withheld until it is possible to get productive results from the money already spent.

We ourselves are more concerned with the absence of any reference to electrification of the collieries because we know that it is true that, as shown by Mr. B. L. Metcalf, chief engineer of the National Coal Board, in his article in the *Electrical Review* of 25th March, 1955, electrification of collieries is a potent way of increasing production.

Next week's issue will contain an illustrated review of the Mechanical Handling Exhibition, which is being held at Earls Court from 9th to 19th May. There are over 200 exhibitors

In our series on domestic electrical appliances we shall be dealing with refrigerators. Included in the particulars given in tabular form will be dimensions, capacity, shelf area, finish, price, etc. Many of the models will be illustrated



I.—Development of the Mo i Rana Steelworks in Norway

IN the north of Norway, thirty miles south of the Arctic circle, there came into production last year an integrated iron and steel works, more fully electrified probably than any other in the world, and whose construction and commissioning in such a remote area must rank among the major industrial achievements of 1955. Built at a cost of £25 million, the plant is capable at present of producing from the ores about 170,000 tons a year of rolled products, utilizing three pig iron furnaces. A second stage of the works will add three more of these, when the annual output should increase to 340,000 tons. The third stage would bring the total to eight furnaces to give an output of about half a million tons yearly.

The works is that of A/S Norsk Jernverk, a specially formed independent company whose capital is owned by the Government, and we are indebted to them for permission to visit their plant and for their kindness and the help which they gave to us.

The maximum electrical demand of the works at present is between 90 and 100 MW, and to supply this a new underground hydro-electric station has been built about 25 miles away to be, when completed, among the largest in Norway. The township of Mo i Rana, hub of all this intense activity, has grown in population from about 2,000 ten years ago to about 8,000 to-day—bringing the inevitable problems of housing, education and social amenities for the new residents.

The new works employs about 1,500, many having been drawn from the construction labour force and having no previous experience of steelworks operation.

Britain has played a large part in the design and construction of the project. The International Construction Co., Ltd., of London acted as consulting engineers for the plant; the blooming mill, section mill and merchant mill were all supplied by the Davy & United Engineering Co., Ltd., although the merchant mill was to the design of the American Morgan Construction Co., Ltd. Most of the electrical plant in the rolling mills is also British, the English Electric Co., Ltd., being the largest contractor.

We propose to describe in this article the iron and steelworks as a whole. A second article will describe the associated hydro-electric station and the considerable power supply arrangements near the ironworks, and a third article will give a more detailed description of the electric pig iron furnaces, which with a load of 20 MW each are the largest yet built in the world, and whose use is so far little known to us here brought up, as we have been, on adequate supplies of coal.

Iron production with charcoal in Norway dates from the middle ages but was abandoned last century when cheap production methods developed rapidly elsewhere. In the inter-war period small-scale production of specialized products was carried out, but only in 1946 was a decision taken to go ahead with a complete new works to be built at Mo i Rana.

Norwegian ores were to be the basis of production and electric smelting was to be used, made possible by the work of the Norwegian engineers Tysland and Hole in the 1920's, in designing a suitable furnace.

Extensive deposits of iron ore exist in the Rana valley, one of them having been worked for many years before the war by the Dunderland Iron Ore Co., Ltd. The estimated reserves so far prospected contain nearly 400 million tons.

The development of suitable concentration methods for the ore has taken a considerable time and this fact, together with the need to construct crushing and separation plants and build up a mining organization, has meant that use of the local ore deposits is not yet possible. At present ore is received by ship from deposits in the far north and from

Panorama of Mo i Rana and the Ranafjord

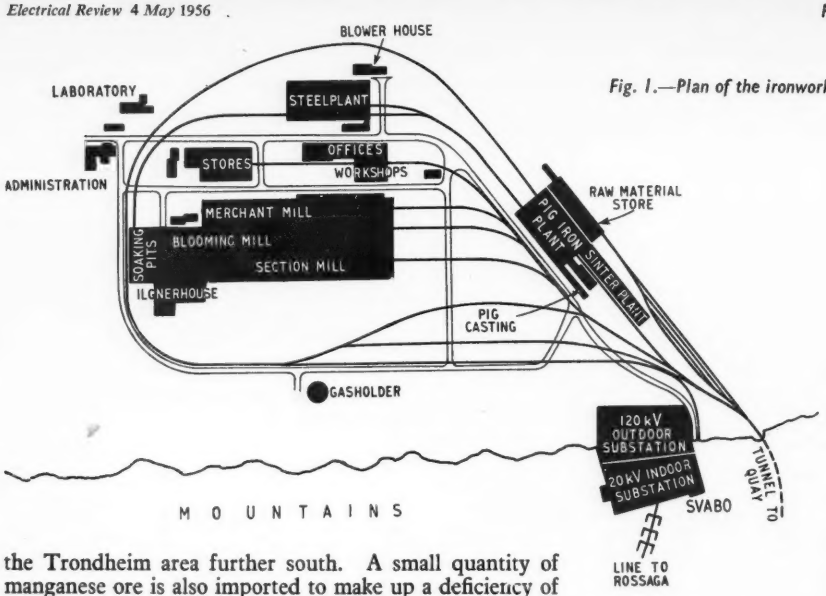


Fig. 1.—Plan of the ironworks area

the Trondheim area further south. A small quantity of manganese ore is also imported to make up a deficiency of this material in the iron ores being used.

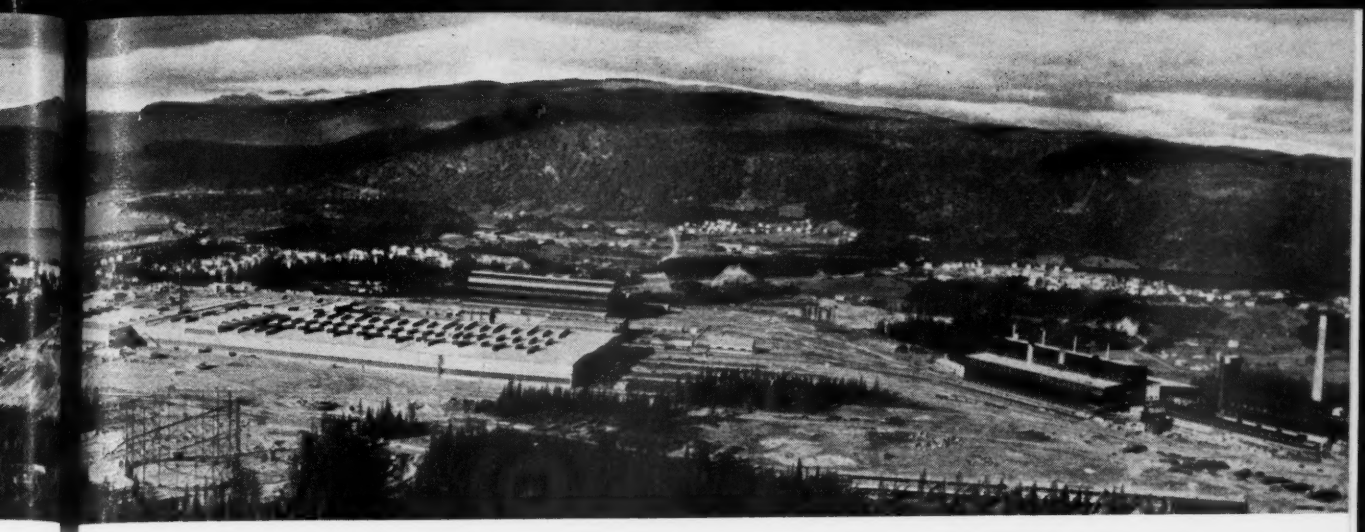
Limestone for smelting is obtained from a quarry about six miles away, about 60,000 tons being needed annually. Crushing, etc., is carried out at the quarry site and the limestone delivered to the works by a cable line $4\frac{1}{2}$ miles long, driven by a single motor at the steelworks end.

Electric power for the works comes from Rossaga, 25 miles to the south-west, where three 40 MW sets have so far been installed and capacity exists for a further three to make an ultimate installed capacity of 240 MW. Two 132 kV overhead lines over the mountains convey power to an outdoor switching station in the ironworks area and cables run into the adjacent mountainside to the underground Svabo substation where the power is transformed to 20 kV for distribution to the various parts of the plant.

Raw materials and outgoing products are handled at a specially constructed quay 270yd long on the Rana Fjord about $2\frac{1}{2}$ miles from the plant. Two overhead cranes of striking design handle most of the bulk goods, two lesser cranes and a fixed crane of 100 tons capacity being provided for other purposes. The quay is linked to the works by an electric railway travelling round the town and through a section of mountain before entering the works area. In the panoramic view which we show, the quay can just be seen on the left. The railway enters the mountain from which the photograph was taken, and emerges on the extreme right where the tracks can just be seen coming into the picture. The railway is electrified to a point some little distance inside the ironworks area, after which diesel locomotives take over. The operating voltage is 15 kV at $16\frac{2}{3}$ c/s.

The panorama also shows the layout of the works. On the extreme right with the chimney is the sinter works and adjacent to it is the pig iron plant. The central buildings are the rolling mills and the taller building behind them the steel plant. Administrative offices, etc., and the entrance are on the left, adjoining the town area. In the foreground is the framework of the gas-holder which stores surplus gas from the iron furnaces. In the title picture on the previous page the railway line running into the bottom of the picture is that into the mountainside; the branch line to the left

Ore unloading in progress



goes to the underground substation. The outdoor 120 kV switching station can also be seen.

The iron-producing process commences in the sinter plant which, although in a separate building, is connected by conveyors to the pig iron plant. Four sinter pans each of 243 sq ft are used, a very high suction being maintained underneath each pan by fans driven from 650 h.p. motors. From here the sintered material passes to storage bins of which there are twenty-four containing all the raw materials required for pig iron production.

A complicated automatic weigher-feeder system has been installed by Strachan & Henshaw, Ltd. Two automatic banks using twelve service bins each are installed, each bin having its own automatic weigher and each bank intended for the supply of two furnaces. Control of these banks is from a single Igranic control desk. Depending on the required mix, the service bins are selected for opening at the control desk, the amount required from each also having been set on the scales. The control desk, as can be seen from the illustration on page 707, has a mimic diagram of the feeder system from which the filling and opening of the hoppers can be seen as the material progresses.

After weighing, the materials are taken on conveyors to a central intermediate hopper after which the cycle is repeated until some seven tons is stored in this hopper. This acts as the storage bin for direct supply to the iron furnaces. A telpher system is used, the operator driving his vehicle on a monorail with a collecting bucket which is lowered into the hopper, lifted up to the charging floor and then driven round on the monorail to the appropriate bin of the furnace.

Three electric pig iron furnaces are so far installed, each having a maximum loading of 20 MW and capable of a yearly production of about 70,000 tons of pig iron. We intend to describe these furnaces and their control arrangements more fully in a separate article.

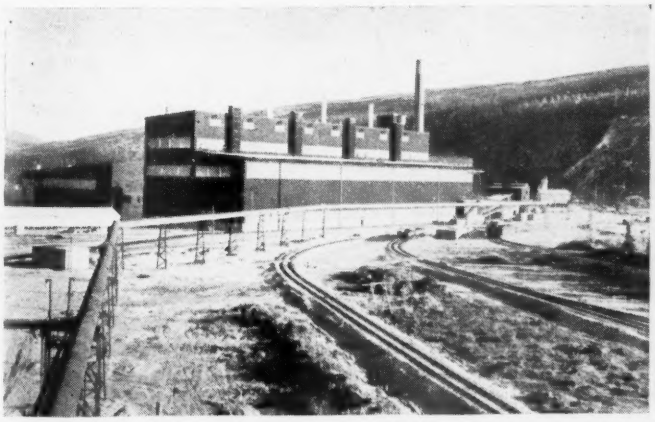
Each furnace can produce up to 200 tons daily of pig iron which is poured at intervals of four or five hours into 60 ton ladles for transport to either a pig casting machine nearby or direct to the mixer in the steel plant.

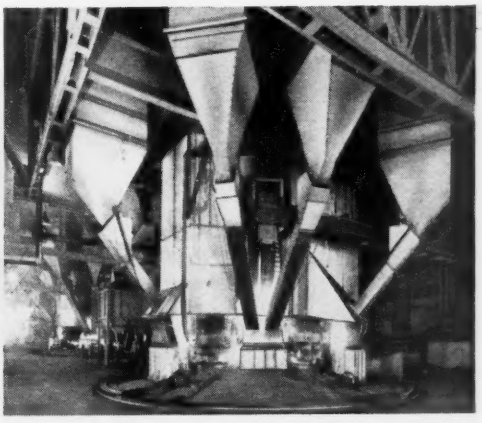
A gas of high calorific value is produced during the smelting process owing to the turning of the coke used into carbon monoxide. About 19,000 cu ft of gas is produced per ton of pig iron, the heating value being about 280 B.Th.U. per cu ft. This gas is led via a system of scrubber cleaners to a gas-holder in the works area. This has a 700 kW electric heating installation to prevent freezing trouble in cold weather.

The three electric iron furnaces are supplied directly from Svabo, the underground substation, at 20 kV. Other 20 kV cables feed to a switchboard within the pig iron plant for local services. The four 650 h.p. motors in the sinter plant operate at 3 kV and are fed from a 3 kV panel in the steel plant, the arrangement being seen in the schematic diagram reproduced. There are over 320 motors of up to 220 h.p., together with the four large ones in the sinter plant, in the whole of the pig iron plant.

In the steel plant are two acid lined, 20 ton Bessemer converters adjacent to a 600 ton mixer fired with gas from

The iron works and looking down the operating floor of the electric iron furnaces





the electric pig iron furnaces. The tilting machinery for the convertors consists of two 160 h.p. motors housed in an adjacent covered building. The blast for the converters is obtained from the turbo-blower in a separate building, this being driven by a synchronous motor rated at 3,000 kW 3·3 kV and running at 1,500 r.p.m. This motor is served by a starting transformer.

At the other end of the steel plant are two electric arc furnaces each rated at 12,000 kVA. These are of Demag manufacture and were acquired as reparations from Germany, having had some years' service in that country before their transfer to Norway. Each has a capacity of 50 tons using mainly scrap metal and can refine a 50 ton quantity in a period of five hours.

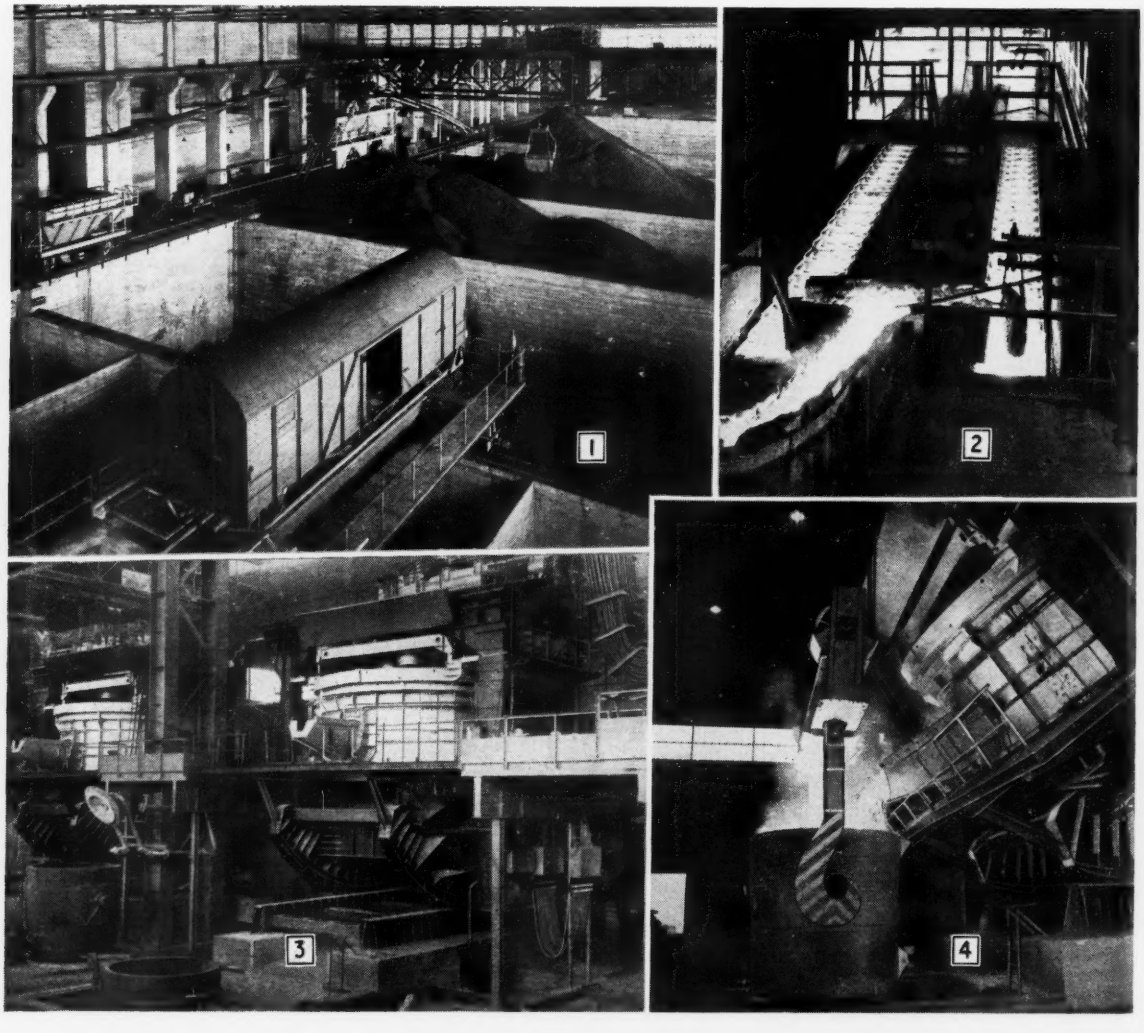
The furnaces can be rotated horizontally 30 deg each way, 45 deg vertically on the tapping side and 15 deg vertically on the slag tapping side. The furnace hearths are 18½ft in diameter and 11½ft high.

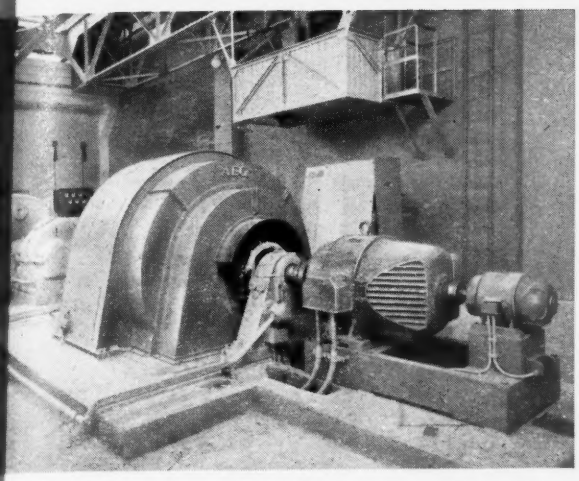
Each of these furnaces is also supplied directly from Svabo by a pair of 20 kV cables of 0·23 sq in cross section. The furnace transformers are situated close to their respective furnaces and are rated at 12,000 kVA, to give a secondary voltage of 106/260 V, on load tap changing being used over a range of 18 steps. 1,000 kVA 1,060 V reactors are in series with each transformer to limit current, particularly when starting to melt scrap; these can be shorted out when required. Electrode movement is regulated by impedance relays controlling d.c. motors, one per electrode.

There is a second main 20 kV substation within the steelworks for local supplies and this also feeds a 3 kV board via two 5 MVA transformers. All the 20 kV switchgear in the three main works substations was made by E.G.A. and is rated at 1,000 MVA. It is of the pneumatic air blast type, operated from small control panels adjacent to each switch. Double busbar design is used, and switches, with their appropriate pneumatically operated isolators, are located in concrete cells with overhead busbars beneath the roof, fully exposed, and vertical copper risers from each cell. The arrangement is similar to that which we shall illustrate at Svabo in our next article. Each substation has its own compressors for circuit-breaker operation.

The 3 kV switchgear is in general of similar open construction to the 20 kV type and is supplied by the de Delle Company of France. It is rated at 210 MVA. The only

(1) Raw material storage bins. (2) Pig iron casting machine. (3) The two electric arc steel furnaces. (4) Steel pouring





Electrically driven turbo blower for the Bessemer converters

exception is the metalclad switchgear in the sinter works, which consists of Reyrolle 150 MVA units.

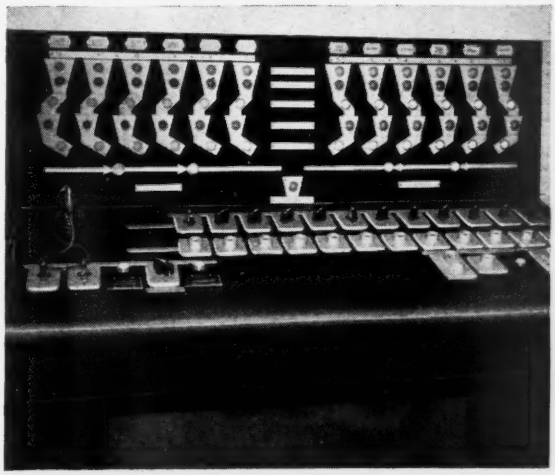
The rolling mills are served at one end by a total of five soaking pits, three gas fired from the iron furnace gas and two electric. The electric pits each contain two electrodes, each of these being supplied by its own 400 kVA transformer nearby. The heating elements consist of a petrol coke filling in a trench of silicon carbide, the current being led in through water-cooled iron electrodes at each end of the trench. The supply transformers have two secondary windings which can be connected either in series or in parallel, and off-load tap changing, the secondary voltage available being variable between 70 and 340 V.

All main electrical plant for the blooming and section mills is in a plant house constructed outside the main mill buildings but adjacent to them. Here are situated the third of the 20 kV works switchboards, a large 3 kV board, and the Ilgner sets feeding the driving motors of the two mills. An auxiliary 20 kV board is fed via reactors from the main board and supplies lighting transformers, etc., in the mills and the adjacent buildings. The use of reactors enables this gear to be rated at only 180 MVA. The 3 kV switchgear is of 210 MVA rating and this, together with the 20 kV gear, is controlled from panels in the main Ilgner hall.

The rolling mill plant consists basically of a 42in wide by 108in, high-lift reversing blooming and slabbing mill; a 32in two-high reversing three-stand structural mill for sizes up to 18in beams; and a Morgan nineteen-stand merchant bar, wire rod and strip mill plant.

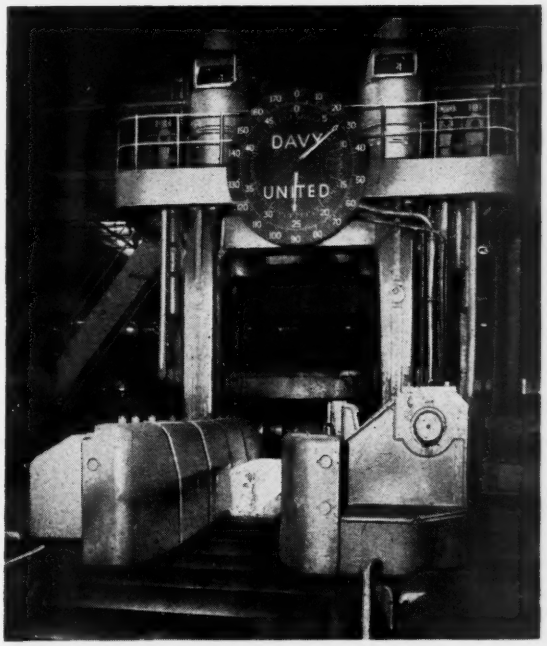
The blooming mill has an associated 900 ton bloom shear and is intended initially for an output of 220,000 tons a year, but with an ultimate capacity of 650,000 tons if required. Although present production is concerned with bloom ingots up to $3\frac{1}{2}$ tons and slab ingots up to 5 tons, the maximum handling capacity is for 12 ton slab ingots and $4\frac{1}{2}$ ton bloom ingots. The bloom shear can make six cuts per minute and is driven by a 500 h.p. 300/900 r.p.m. motor. The mill drive consists of reversing twin motors, one driving the upper roll and one the lower. Each operates at 1,200 V d.c. at speeds from 50 to 120 r.p.m. in either direction and a complete reversal from 50 r.p.m. in one direction to 50 r.p.m. in the other is effected in 2 sec. Each motor has a normal full load of about 3,500 h.p. and a peak cut-out h.p. of about 9,500. The motors are connected in parallel and operate together to give a total cut-out torque on the mill of 300 metre-tons. Power for these motors is supplied by an Ilgner set consisting of a 3 kV, 5,000 h.p. slip-ring induction motor, three d.c. generators each rated at 1,904 kW at 405 V and a 40 ton flywheel having an equivalent energy content at 600 r.p.m. of 180,000 kW-sec. The synchronous speed of the Ilgner set is 600 r.p.m. and the normal working speed between 470 and 590 r.p.m. Control of the induction motor is by liquid rotor resistances and an automatic slip regulator. The driving motors and the Ilgner sets were supplied by the German Siemens Company.

The section mill is intended for an output at present of the order of 200,000 tons a year and the three stands are driven by a reversing 6,000 h.p. motor working at speeds from 80 to 180 r.p.m. in either direction. The peak cut-out rating is about 19,000 h.p. The finishing stand can later be driven by a separate electric drive and when this is installed the ultimate capacity of the mill will be about 350,000 tons a year. Associated with the section mill are a 350 ton electric billet shear, an electric sliding frame



Igranic control panel on the automatic furnace batching plant

The blooming mill at work



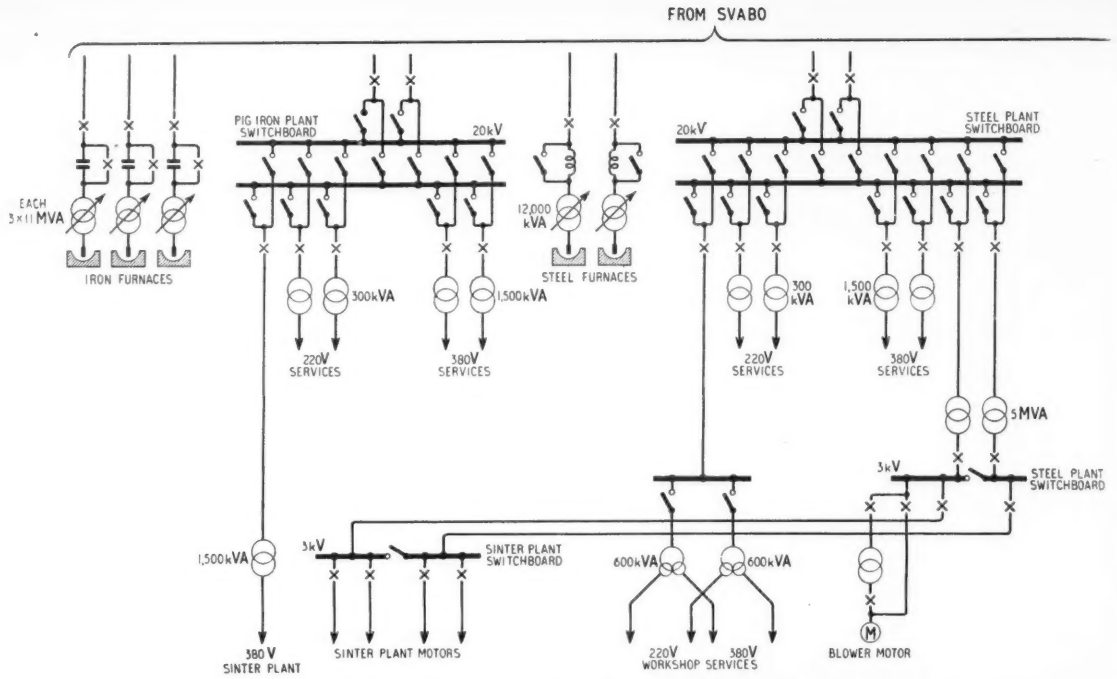


Fig. 2.—Above and on the opposite page are shown the principal electrical circuits in the works

hot saw, cooling banks, roller tables and transfer handling gear. Power for the structural section mill motor already referred to, is supplied by a second Ilgner set identical with that described for the blooming mill motors.

All the main auxiliaries in the blooming mill have Ward Leonard control. These comprise the various tables, manipulator racks, breast rollers and screw downs numbering in all 14 motors with an aggregate horse-power of 1,600. These motors are all supplied from individual variable voltage generators on two Ward Leonard sets in the Ilgner house. By means of special change-over switches all motors can be switched over to one set so that the whole mill can continue to run even if one of these sets is out of action, although in this event the motors would operate at half normal speed. These Ward Leonard sets are driven by 850 h.p. squirrel cage induction motors of 3·3 kV, 1,000 r.p.m. with a peak output 2½ times normal full load.

The bloom shear is driven by a non-reversing d.c. motor giving a normal output of 545 h.p. at 1,000 r.p.m., 630V, and fed from an additional Ward Leonard set in the Ilgner house.

The various small motors associated with both these mills are of the 440 V, d.c. type where frequent reversing or starting operations are required. In other cases 380 V a.c. motors are used. To feed the d.c. motors two 500 kW mercury arc rectifiers have been installed supplied by rectifier transformers from the 3 kV switchboard. All the Ward Leonard sets, the auxiliary motors for the mills and the two mercury arc rectifiers were supplied by the English Electric Co. and the contactor gear for all the d.c. auxiliaries by Igranic.

The merchant mills consist of a seven-stand rough train, a four-stand intermediate rough train, a two-stand looping train and a six-stand rod finishing train, together with furnace charging gear, automatic shears, coiling and handling equipment, etc. Finishing speeds of over 4,000ft/min are possible.

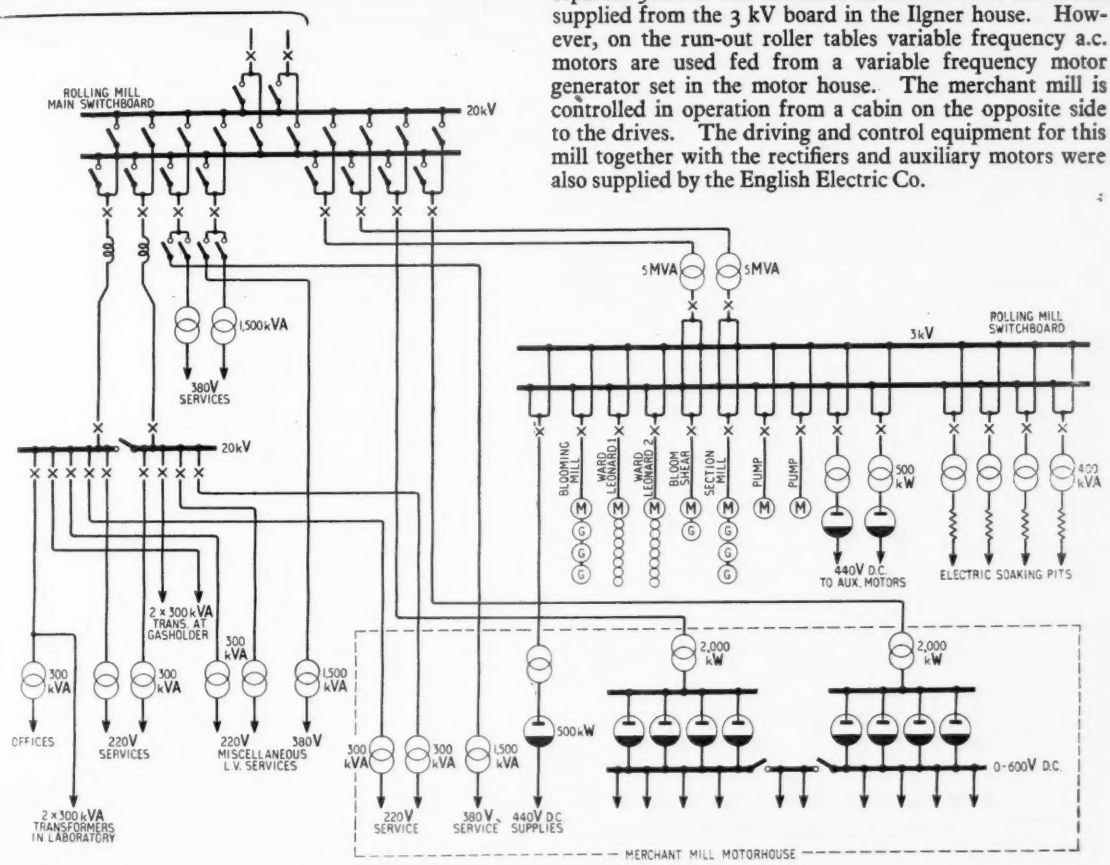
On the present basis of construction a total output is envisaged from this mill of 80,000 tons from all plant and later this is expected to reach an ultimate capacity of about 150,000 tons.

Descaling equipment for both the section and merchant mills has been provided by the Harland Engineering Co. and is in the form of a high pressure water spray system with a maximum pressure of 1,500 lb/sq in. A pump set driven by a 425 h.p. Harland squirrel cage motor is provided for each of the mills. Scale from all the stands is washed down a flume into a common scale pit and is later returned to the electric arc steel furnaces.

A separate motor house is provided for the merchant bar, rod and strip mill, the motors being erected along one side of the motor house with the mill stands on the opposite side of the wall. All the main motors operate on 600 V

The merchant mill: the motor house is behind the concrete wall

separate 500 kW rectifier situated in the motor house but supplied from the 3 kV board in the Ilgner house. However, on the run-out roller tables variable frequency a.c. motors are used fed from a variable frequency motor generator set in the motor house. The merchant mill is controlled in operation from a cabin on the opposite side to the drives. The driving and control equipment for this mill together with the rectifiers and auxiliary motors were also supplied by the English Electric Co.



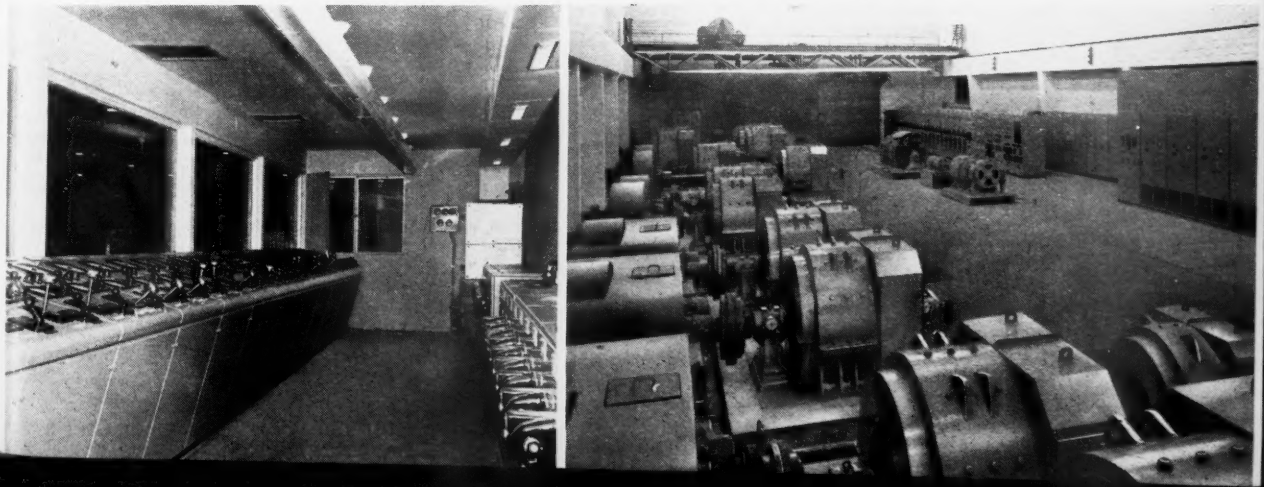
d.c. fed from two 2,000 kW rectifier banks on the opposite side of the motor house. In all there are seventeen main motors with horse-powers at maximum speed ranging from 150 up to 1,250. Excitation of all the motors is supplied from a constant voltage 100 kW, 220V exciter driven by a squirrel cage induction motor. Pumpless steel tank rectifiers are used to feed the main motors, each 2,000 kW bank consisting of four units each of 500 kW. The rectifiers are fed at 20 kV via rectifier transformers with on-load tap changing arranged to give a d.c. range at full load of 300 to 600 V. Grid control on the rectifiers makes control of the d.c. voltage possible between zero and 600 V.

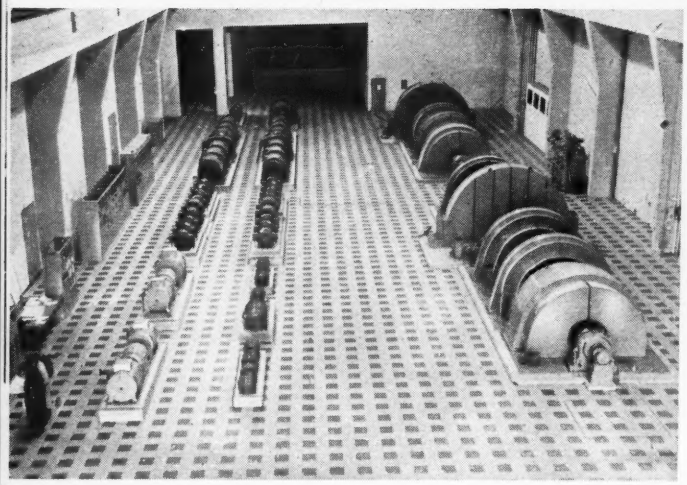
The smaller auxiliaries are either d.c. or a.c. as in the blooming and section mills, the d.c. being supplied via a

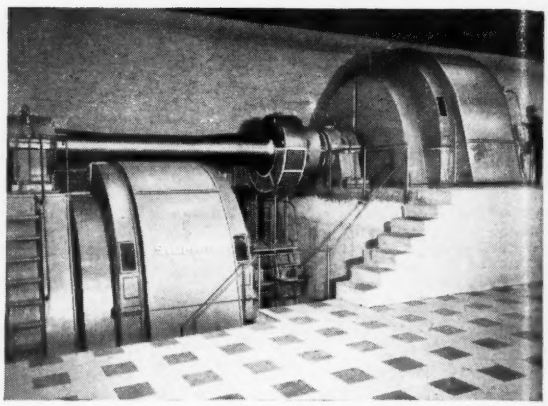
For both the Ilgner house and the merchant mill motor house considerable ventilating plant is installed and normally a slight excess pressure is maintained in both rooms to guard against the ingress of dust from the outside.

The high voltage system has been described during the course of the preceding pages. For low voltage a.c. supplies two separate voltages are provided as can be seen from the distribution diagram. At every point where low voltages are required two separate transformers are provided, one for 220 V, three-phase, and one for 380 V, three-phase, in most cases two of each type actually being provided and their low voltage sides kept separate to prevent excessive short circuit currents in the event of l.v. faults. The 380 V, three-phase system is used to supply

Control cabin for the merchant mill operators and (right) all-British equipment is used in this motor room for the merchant mill







Left: Looking down on the Ilgner house. The twin driving motors of the blooming mill (right) are in the annex at the far end

motors, cranes, heating units, etc., and has an earthed neutral. The 220 V, three-phase system is used for lighting and for a few isolated motors and heaters. The neutral of this system is isolated and load is taken between phases. Although the neutral point of the 380 V system is earthed, load is not taken between phase and neutral.

In general l.v. panels are of open construction with fuses of the circular screw-in type. Switches are not normally provided on these panels except for crane feeders and interconnectors.

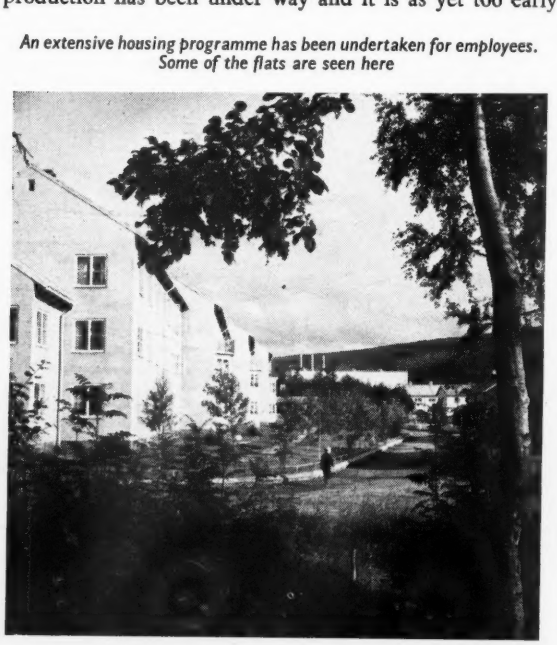
Blended lighting fittings have been chosen for the pig iron plant and the melting shop using one 1,000 W tungsten lamp with one 450 W mercury lamp. In the rolling mills the intention is to use fluorescent colour corrected mercury lamps of 1,000 W rating but until these are obtainable in Norway, 2,000 W tungsten lamps are used.

The situation of these works so close to arctic regions leads to the use of electric heaters at innumerable points to facilitate the operation of water valves, etc., and these miscellaneous services absorb a considerable quantity of power. The present winter is the first during which production has been under way and it is as yet too early to say what difficulties will be produced by the intense cold. The lubrication of the innumerable items of rotating plant is a special problem when the temperature can drop to −25 deg F for lengthy periods as was the case on the occasion of our own visit.

An approximate analysis of the maximum demand at the works is as follows:—

Sintering plant	2,500 kW
Pig iron furnaces	60,000 kW
Electric arc furnaces	16,000 kW
Bessemer converters	3,000 kW
Electric soaking pits	1,500 kW
Rolling mills	8,000 kW
Auxiliary motors, lighting, etc.	5,000 kW
Total:	96,000 kW

An extensive housing programme has been undertaken for employees. Some of the flats are seen here



The Mo i Rana iron works of A/S Norsk Jernverk is probably more beautifully situated than any other in the world and the impression given is that it will in no way mar its surroundings, the extensive use of electricity resulting in far less dust and smoke; and it was noticeable that the snow which surrounded buildings on the occasion of our visit, although not freshly fallen, was still clean.

In our next article we propose to describe the hydro-electric station and its associated works at Mo i Rana which have been necessary to provide the large quantity of power required.

Nuclear Power Stations

THE consumption of electricity in the United Kingdom will increase 3½ times in the next twenty years, stated Sir Donald Perrott, K.B.E., finance and administration member of the United Kingdom Atomic Energy Authority, addressing the London Regional Conference of the Purchasing Officers' Association on 21st April. The proposed programme for the building of twelve atomic power stations between 1965 and 1970 would produce only one-twentieth of the national demand for electricity. If all went well, however, it should be possible by the early 1970s to expand the rate of construction on nuclear power stations so that by 1975 they could produce nearly one-quarter of the national consumption.

Regarding the actual construction of these power stations, nearly 80 per cent was composed of conventional material and equipment. Industry in general would be much more concerned with the industrial applications of the isotope, and the industrial advisory service at Harwell received about two thousand inquiries a year.

Consumers' Sampling Survey

Domestic Appliances Installed in England and Wales

IN 1946, the Electricity Supply Technology Section of the Electrical Research Association organised a sampling survey of domestic consumers, in which some 60 undertakings, supplying about one-third of all consumers in Great Britain, took part. The detailed results were embodied in a comprehensive report,[1] which was followed by a brief supplement[2] giving results of a condensed repeat survey made in 1948. As participation depended on E.R.A. membership and interest in work of this kind, the total sample covered could not be regarded as accurately representing the conditions in the whole country, but in the absence of any national statistics of the kind concerned, some of the information has been found helpful in connection with the nationalisation of the industry and by several Government committees, apart from the benefit derived by the participating undertakings and the Area Boards in which they have been incorporated. Upon transfer of the E.R.A. Section concerned to the Central Electricity Authority, the data collected were also used[3] for computing annual consumptions for various appliances and uses, such as cooking, water heating, space heating, etc., and studying the trend of these uses in the years 1945 to 1948.

When the preoccupation of Area Boards with urgent matters of organisation, tariff standardisation, etc., had abated, the Utilisation Research Committee of the Central Authority and Area Boards recommended that a new survey be carried out. In order to facilitate analysis of the total of returns in various directions, a uniform sampling fraction of one per thousand was adopted, but some Boards decided to select larger samples, which would yield reliable information also for smaller territorial units, such as Districts. The consumers selected were visited in the first quarter of 1955, the same data sheet being used throughout, and—with few exceptions—ready co-operation was obtained.

The accompanying table gives some results of a preliminary punched-card analysis of the returns, excluding the former South West Scotland Board, which also took part, but has since been incorporated in the new South of Scotland Electricity Board. At the time of the survey, there were about 12 million domestic consumers in England and Wales, and the information derived from the aggregate sample of close on 12,000 can be regarded as reflecting the true position with satisfactory accuracy.

It will be seen that close on 25 per cent of all consumers were found to have an electric cooker. Excluding " breakfast," or " baby," cookers, the figure falls to 21 per cent. Nearly 80 per cent of the consumers with any type of electric cooker also had an electric kettle, while 77 per cent of all consumers with some kind of electric cooker did not use any alternative means of cooking. Nearly half

ELECTRICAL APPLIANCE SATURATION FACTORS AND OTHER DATA FOR DOMESTIC CONSUMERS IN ENGLAND AND WALES (WINTER OF 1955)

(1) GENERAL		
Size of sample		11,900
Rural consumers (*a*)	%	8·8
Average number of rooms (*b*)		5·2
Average size of household		3·2
(2) COOKING		
Electric Cooker		
Total S.F. (*c*)	%	24·5
Proportion full-size	(%)	85·7
Proportion breakfast-type (*d*)	%	14·3
Proportion with electric kettle	%	79·0
Proportion where all cooking done on electric cooker	%	77·3
Full-size only—		
Average number of plates, including grill-boiler, per cooker		2·4
Proportion having at least one radiant plate	%	34·1
Proportion having at least one " Simmerstat "	%	47·2
Proportion with oven thermostat	%	63·8
Electric Kettle, S.F.	%	30·0
Boiling Plate, S.F.	%	2·3
(3) WATER HEATING		
Electric Water Heater, any type, S.F.	%	20·6
Immersion Heater, S.F.	%	16·4
Average capacity	gal	26·1
Average loading	kW	2·7
Side entry	(%)	36·2
Top entry	(%)	63·8
Proportion with thermostat	%	88·0
Proportion unlagged	%	45·7
Proportion practically not used in winter	%	41·0
(3) WATER HEATING (*contd.*)		
Large Self-contained Water Heater, S.F.	%	1·6
Average capacity	gal	18·2
Average loading	kW	2·1
Sink Heater, S.F.	%	3·3
Average capacity	gal	1·8
Average loading	kW	0·8
Proportion of consumers keeping a heater switched on all night	%	26·0
Washboiler, S.F.	%	11·8
(4) SPACE HEATING		
Electric Space Heating, S.F.	%	60·5
Average installed space-heating load:		
All consumers	kW	1·42
Space-heating consumers only	kW	2·35
(5) OTHER APPLIANCES		
Washing Machine, S.F.	%	17·5
Iron, S.F.	%	90·0
Refrigerator, S.F.	%	8·1
Proportion compressor-type	%	70·7
Mains Radio, S.F.	%	90·6
Television, S.F.	%	34·7
Filament Lamps		
Average number		9·0
Average wattage per consumer		620
Fluorescent Lamps, S.F.	%	1·0
Average no. per consumer having		1·6
Average wattage per consumer having		90
Socket-Outlets		
Proportion of consumers without any	%	6·0
Up to 5 A:		
Proportion of consumers	%	67·3
Over 5 A:		
Proportion of consumers	%	57·9

NOTES: (*a*) Consumers living within the area of a Rural District Council in a village or hamlet of not more than about 50 dwellings, or in isolation. (*b*) Excluding South Eastern and Eastern Boards. (*c*) S.F.—Saturation Factor. Bracketed percentages add to 100. (*d*) " Baby " type, including breakfast cookers with or without oven.

the full-size cookers had at least one boiling-plate with stepless control, and over one-third lacked an oven thermostat.

Some 20 per cent of all consumers possessed one or more electric water heaters. Slightly over 16 per cent had an immersion heater, and some 64 per cent of the heating elements were of the top-entry type, which in the north of the country is likely to be identifiable with the circulator type. Only some 12 per cent of the immersion heaters had no thermostat and something like 46 per cent were found to be unlagged. Upwards of 40 per cent of all consumers said they hardly used their immersion heaters at all in the winter, thus confirming what is already known about the favourable load characteristics of this type of appliance. Large self-contained heaters (including the under-draining-board type) and sink-heaters had saturation factors of 1·6 per cent and 3·3 per cent respectively. Only a quarter of all consumers with water heaters kept at least one switched on all night. About 60 per cent of all consumers had one or more electric space heaters, and these heaters represented an aggregate installed load of the order of 17,000 MW.

Among other appliances, electric washing machines revealed a rather surprisingly high saturation of 17½ per cent. In some coal-mining areas the saturation factor was particularly high. About 8 per cent of consumers had an electric refrigerator, and 35 per cent a television set. With an average number of nine lamps, aggregating 620 W, per consumer, the average wattage per lamp was close on 70 W. Fluorescent lighting had found entry into 1 per cent of the homes involved. Only 6 per cent of consumers had no socket-outlets whatever, whereas 58 per cent had power outlets.

The survey has revealed some interesting facts, such as that one in four consumers now use electric cooking, and one in five, electric water heating. Henceforth, a firm basis will be available for keeping under review the course of development, for the samples selected by the individual Area Boards are being added to by an appropriate proportion of all new consumers, thus forming permanent samples, which can be re-surveyed periodically. The returns now obtained are being analysed in several other ways, e.g. in respect of consumption for certain services, and eventually a comprehensive report will be issued on this largest systematic survey of domestic electricity consumers ever undertaken.

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1. E.R.A. Report Ref. K/T125: "A Large-Scale Sampling Survey of Domestic Consumers."
2. Supplement to Report Ref. K/T125: "A Condensed Repeat Survey for 1948."
3. C.E.A. Utilisation Research Report No. 4: "A Further Analysis of the Returns of the E.R.A. Sampling Survey of Domestic Consumers."

Snowy Mountains Scheme

Preparations for Next Stage of Development

TENDERS for the next stage of Australia's Snowy Mountains hydro-electric and irrigation scheme are to be invited this month. Mr. C. M. Gray, O.B.E., senior representative of the Australian Department of National Development, in a paper presented to the Royal Society of Arts last week, said that this part of the project (the Tooma diversion) would involve the construction of a 225ft high dam and a tunnel nine miles long and 13ft wide.

Outlining the Snowy scheme, he said it was by far the largest project in the Australian programme of development work and would bring great and enduring benefits. The total estimated cost was more than £A400 million. Its primary role was to handle the peak loads of New South Wales and Victoria. Nevertheless, the storages which must be provided to take care of seasonal fluctuations in precipitation and control the natural run-off were on so large a scale as to admit of the entire complement of generators operating at full output for lengthy periods when once the storages had been filled. Integration with the thermal power stations of Victoria and N.S.W. was already planned. Perhaps in course of time the Snowy scheme would also be linked with the South Australian system and with Tasmania, but integration on this scale must await further technical developments in long-distance transmission.

Responsible Authority ..	Snowy Mountains Hydro-Electric Authority, Cooma, N.S.W.
Projected generating capacity ..	3,070,000 kW
Area and volume of storages ..	7,040,000 acre-feet
Major dams	Seven (largest, 390 ft high, rock filled type; storage 3,500,000 acre-feet)
Major tunnels	83½ miles in total length, and up to 30 ft in diameter
Power stations	Seventeen (largest, 540,000 kW, ten underground)
Head	Greatest 1,775 ft. Least 145 ft
Water for irrigation	2,000,000 acre-feet per annum
Estimated total cost	£A422 million; £A62 million spent by June 30th, 1955
Date of commencement ..	October, 1949
Date of completion of first significant step	April, 1955 (60,000 kW); 380,000 kW by 1960
Transmission voltage	Mainly 330 kV; some 132, 66 and 11 kV

Mr. Gray said that the Guthega part (60,000 kW) on the Upper Snowy River had already been completed, the turbines and generators having been supplied by the English Electric Co., Ltd., and the transformers by the Hackbridge & Hewittic Electric Co., Ltd. The centre of activity was now the Snowy Tumut development. No British tenders were received for the construction of this group of works, for which contracts were let in 1953 to the total value of £A30 million. Four turbines had been ordered from the English Electric Co. for the T1 station and four from A.S.E.A. (Sweden). Seven transformers were to be supplied by a Belgian firm. (Last year it was stated that the authority had rejected a number of British tenders which were practically identical.)

The next part of the programme was the Tooma diversion. Planning work was also in hand for the T2 station (280,000 kW) and tenders for the generators were expected to be called shortly.

Increased Food Production

By 1963, or a little earlier, the diverted waters of the Snowy and the Tooma, with augmentation from other sources, would be reaching the Murrumbidgee to the extent of 500,000 acre-feet per annum and in due course about 2 million acre-feet would be added to the present flow of the Murray and the Murrumbidgee. This water would enable the irrigated areas to produce annually upwards of £A25 million more of foodstuffs, etc., yet it would cost the States nothing, for the entire cost of the Snowy Mountains scheme would be financed by the sale of its output of power.

VIEWS on the NEWS

By REFLECTOR

A CORRESPONDENT complained in last week's issue that the standards of engineering products are not what they were. Although this is a generalisation it is true that a good many products are nowadays not all that they should be, more's the pity. There is no doubt that British workmanship is very good on the whole but a few examples of shoddiness or carelessness can damn the whole. Wartime and post-war exigencies compelled manufacturers to lower their quality because of scarcity of materials, but this can no longer be pleaded in extenuation of flimsiness. The correspondent mentioned the durability of earlier heavy engineering products—pumps, gas engines and milling plant—but were these not too substantial? Advance of knowledge, particularly of materials, has led to considerable economy; the pioneer engineers were forced to adopt wide safety margins. There is, too, something in the American idea that machines should not be made to last for ever. Constructors should aim at giving their machines a reasonable life. Too robust a design may militate against the adoption of more modern, improved, machines.

* * *

Commenting upon Mr. Kruschev's question whether the British did not want more trade with Russia, the *Manchester Guardian* condemns the system of "bilateralism and matched transactions" (which seems to me to be a circumlocution for barter) favoured by the Soviet bloc countries. The *Guardian* says:—

> "It does not encourage a British manufacturer of electrical goods when he discovers that he must find someone in the West to buy Hungarian goose-feathers in return before he can get his contract signed."

How embarrassing this could be if it were considered that a turbo-alternator was worth its weight in goose-feathers.

* * *

An estate agent's advertisement in *The Times* lists the virtues of a country cottage. One of the attractions is "main electricity 50 yards away." Is this another case of so near and yet so far? I read of many complaints by dwellers in rural areas that although grid lines pass their doors, as it were, they are still unable to obtain a supply. They cannot understand why this should be so, having no knowledge of what is involved in tapping a 132 kV line.

* * *

One has to be very careful in commenting on solid fuel. Recently, Sir Ernest Smith, president of the National Smoke Abatement Society, said that solid fuel would be "taboo" in the home in twenty years' time. Immediately Mr. J. S. Williams of the Coal Utilisation Council jumped on him whereupon Sir Ernest explained (in the *Manchester Guardian*) that he was referring to new homes, "especially to those which can be designed and equipped with some regard to heating efficiency and convenience." He went on to say that already there is a trend towards the adoption of newer methods "due to a desire to save labour and to enjoy higher standards of comfort and convenience." Although Sir Ernest Smith is a "gas" man it is possible he had electrical appliances in mind too.

* * *

I felt that I was perhaps being a little daring in suggesting last week that many of the alleged shortcomings of domestic electrical appliances arose from the way in which housewives handled them. So I am glad to have support from Kay Hudson who says in the *Birmingham Mail*:—

> "We housewives are an odd race. We take the wildest chances with our home equipment. We misuse them, overwork them, underclean them, complain bitterly about them when they wear out, and always refuse to admit that it might be our own fault if something goes wrong."

She goes on to deal with the severe tests to which appliances are subjected by the Midlands Electricity Board at its Appliance Testing Centre. This is a matter in which the Electrical Association for Women has taken a beneficent part; its members learn to respect their electrical appliances to get the best out of them and no doubt they extend their influence to their friends and neighbours, for which appliance makers should be grateful.

* * *

Troublesome birds are in the news again. The Blackpool Corporation has just spent £35,000 on a new lighting system for the promenade (it was described in the *Electrical Review* of 20th April) but already it is having trouble with seagulls who use the standards and lanterns as perches. Local papers report that the Street Lighting Department sought to foil the birds (whose habits are not impeccable) by fixing three-inch spikes to the tops of the lamps. The seagulls soon got used to these and adjusted their angle of approach to avoid them and so the Department adopted attachments with spikes mounted at a 30 degree angle. So far this seems to have been successful but no doubt the gulls will think something out.

* * *

What was probably the origin of the "Dial 999" system was reported in the *Electrical Review* of 7th May, 1886. I reproduce the report as it appeared:—

> "*An Arrest by Means of the Telephone.*—Shortly before four o'clock on Thursday morning, last week, a housekeeper on the premises occupied by Messrs. Bennett and Roach, Queen Square, Bristol, called the attention of the telephone operator to the fact that there were burglars in the house. The operator immediately communicated by telephone with an officer at the sessional court-house in Bridewell Street, and explained the singular nature of the message which he had received. He was informed that assistance would be sent without delay, and, about an hour after, an inquiry by telephone received the welcome reply that the constables who had been despatched to Queen Square had succeeded in making an arrest. The burglar was sentenced to three months' imprisonment."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Before calling on Professor Lovell to deliver the forty-seventh Kelvin Lecture last week, the President of the Institution of Electrical Engineers (Sir George Nelson) presented a vellum certificate to **Sir Stanley Angwin,** K.B.E., D.S.O., M.C., T.D., D.Sc.(Eng.), recording his election as an honorary member of the Institution. The thirty-fourth award of the Faraday Medal was also made to **Emeritus Professor G. W. O. Howe,** D.Sc., LL.D., M.I.E.E., followed by the presentation of the Page and Institution Prizes.

Mr. Robert Neill, chairman of Robert Neill & Co. (Sheffield), Ltd., electrical wholesalers, has been elected Lord Mayor of Sheffield. He is president of the Heeley Parliamentary Division of the Conservative Association, and chairman of the Netheredge Ward of the Sheffield Conservative Association. He has been a member of the Sheffield City Council since 1932.

Mr. Robert Neill

The Metropolitan-Vickers Electrical Co., Ltd., announces that, following the appointment of **Mr. J. T. Thornhill** as an executive director of Siemens-Ediswan, Ltd., **Mr. J. E. A. Heale,** A.M.I.P.E. (formerly superintendent, X-ray section, Motherwell), has been appointed works manager, Motherwell works, and **Mr. E. Turnbull,** formerly assistant superintendent, Instrument and Meter Department, Trafford Park, has been appointed superintendent of that department.

Mr. R. W. D. Jack, B.Sc.(Eng.), who has been chief production engineer in the Instrument and Meter Department, is now assistant superintendent of the department, **Mr. F. B. Lawrence,** formerly development engineer at the Motherwell Works, has been appointed assistant superintendent, Meter Department, at Motherwell, and **Mr. G. L. Brown,** who has been chief production engineer at the Motherwell Works, has become assistant superintendent, X-ray Department, at Motherwell.

Dr. Willis Jackson, F.R.S., director of research and education, Metropolitan-Vickers Electrical Co., Ltd., is to have an honorary D.Sc. degree in engineering conferred upon him by Bristol University on 3rd July.

The following changes in representation on the Electrical Fair Trading Council have been made:—The Electric Discharge Lamp Auxiliaries Council: **Mr. A. L. Randall** (Crompton Parkinson, Ltd.) has resigned, and **Mr. D. W. Durrant** (General Electric Co., Ltd., chairman of E.D.L.A.C. 1956-57) has been appointed. The Electrical Wholesalers' Federation: **Mr. W. H. Swain** (Hirst, Ibbetson & Taylor, Ltd.) has resigned and **Mr. H. Riley** (John Riley & Son, Ltd.) has been appointed.

Mr. R. T. Sutton, A.M.I.E.E., who joined Lancashire Dynamo & Crypto, Ltd., as an apprentice thirty-three years ago, has been appointed chief engineer of the company's Willesden Works in succession to **Mr. L. E. Saker,** who will continue to be associated with the company in an advisory capacity. In his new appointment Mr. Sutton will control and co-ordinate the activities of the drawing office, design and service departments.

Mr. T. E. Trotman has been appointed sales manager of the Household Appliances Department of the Simplex Electric Co., Ltd. Mr. Trotman will be based on the company's new London offices at 26-28, Binney Street, off Oxford Street, W.1. After release from the Royal Air Force at the end of the war, Mr. Trotman joined Thor Appliances, Ltd., as advertising and sales promotion manager, subsequently being appointed sales manager. He left Thor Appliances in January, 1955, to join the Household Sales Department of Frigidaire.

Dowty Group, Ltd., announce the appointment of **Mr. R. F. Hunt,** A. F. R. Ae. S., A.F.C.Ae.I., to the board.

Mr. R. F. Hunt

Mr. Hunt joined Dowty's in 1935, being one of the company's first two apprentices. He became a designer and in the following year was appointed chief instructor of the Dowty School of Hydraulics. In 1944 he undertook technical liaison duties between Dowty's in England and in Canada and in 1946 he was appointed export manager. He became vice-president and general manager of Dowty Equipment of Canada, Ltd., in 1949 and in 1954 was appointed president; he will retain that position.

Mr. Peter B. Etheridge has been appointed as director and secretary designate of the Electrical Wholesalers' Federation with effect from 22nd May. He will succeed Mr. A. B. Wildsmith in the course of a year or two. Mr. Etheridge was born in 1919 and was educated at Merchant Taylors' School and University College, London. From 1939 to 1946 he served in the infantry and the Royal Artillery, seeing active service in the Middle East and in Italy. On release from the Services, with the rank of captain, he was articled to Corbould, Rigby & Co. until 1949 when he was admitted a solicitor and became a managing clerk. Later in the year he joined the Federation of Civil Engineering Contractors as assistant secretary and later became legal joint secretary, which position he will be leaving to join the E.W.F.

Mr. J. Bruce Shepherd has been appointed to the staff of the Electrical Industries Benevolent Association as

Mr. J. E. A. Heale

Mr. E. Turnbull

Mr. R. W. D. Jack

Mr. F. B. Lawrence

Mr. G. L. Brown

manager of its general office. Mr. Shepherd, who was a lecturer with the British Council in Spain for three years until 1953, was latterly manager of the Research Department of the Continental and Overseas Organisation, publishers of *Electrical Industries Export* and *Machinery Lloyd*.

At the annual general meeting of the Society of Glass Technology at Sheffield on 25th April **Mr. J. H. Partridge,** D.Sc., Ph.D., F.S.G.T., was elected president in succession to **Sir Graham Cunningham,** who retired after serving for two years. Before the election of the president, **Dr. B. P. Dudding, Mr. E. Meigh** and **Sir Graham Cunningham** were elected honorary fellows and were presented with illuminated letters. Dr. Partridge is head of the Glass, Refractories and Ceramics Department of the General Electric Co., Ltd.

Metal Industries, Ltd., announces that **Mr. J. O. Knowles** has relinquished his chairmanship and has resigned from the board of Brookhirst Switchgear, Ltd.; he retains his seat on the board of Metal Industries, Ltd. As a mark of appreciation of his thirty-seven years' service to the company, the directors have appointed Mr. Knowles hon. president of Brookhirst Switchgear, Ltd.

Mr. J. O. Knowles

Mr. E. Bruce Ball, C.B.E., has been appointed to the board of Brookhirst Switchgear, Ltd., and becomes chairman in place of Mr. Knowles.

Mr. D. R. Parsons, M.I.E.E., M.Brit.I.R.E., who for the last eight years has been chief engineer of Rediffusion (North-East), Ltd., has been transferred to Rediffusion (Merseyside), Ltd., as general manager. Mr. Parsons was previously with Eddystone Radio, Whitely Electrical Radio Co. and the G.E.C.

Mr. R. H. Falconer and **Mr. G. S. Haynes,** who have been associated with Hendrey Relays, Ltd., for many years, have been appointed directors.

The following appointments have been made by the A.E.I. Lamp & Lighting Co., Ltd.:—

Mr. W. C. Huston, who has been marketing manager of the Lamp and Lighting Department of the British Thomson-Houston Co., Ltd., becomes manager of the Lamp Sales Division of A.E.I. Lamp & Lighting. Mr. Huston, who is also a director of Claude-General Neon Signs, was chairman of the Electric Discharge Lamp Auxiliaries Council from 1949 to 1954.

Mr. C. W. M. Phillips, A.M.I.E.E., F.I.E.S., manager of the Lighting Department of the B.T.H. Co., has been appointed manager, Lighting

Mr. W. C. Huston

Mr. C. W. M. Phillips

Mr. O. W. J. Farmer

Sales Division, of the new company, and **Mr. O. W. J. Farmer,** manager of the B.T.H. Advertising Department, becomes manager of the Publicity Division.

Mr. E. W. Taylor, on reaching the normal pension age, relinquished the position of joint managing director of Cooke, Troughton & Simms, Ltd., on 30th April, and **Mr. J. Simms Wilson,** the other joint managing director, relinquishes that position at his own request on 31st May. They will both remain on the board of the company. **Mr. P. D. Scott Maxwell,** assistant managing director, becomes managing director on 1st June. **Mr. H. Wright,** secretary of the company, is joining the board and will become commercial director on 1st June. He will continue as secretary.

The South of Scotland Electricity Board announces the appointment of **Mr. J. B. C. Brown,** M.A., LL.B., as secretary of the Central Area with headquarters at Stirling. Mr. Brown, who is at present secretary of the Dumfries and Galloway Area, was previously principal assistant (legal), in the Secretary's Department of the former South East Scotland Electricity Board and secretary of the South East Scotland Electricity Consultative Council.

Le Carbone (Great Britain), Ltd., announces that **Mr. Léon Wintrebert,** general manager of the French company, Société Le Carbone-Lorraine, is joining the board. Mr. Wintrebert, who is a graduate of the French Ecole Polytechnique and was chief engineer in the Génie Maritime, joined Société Le Carbone-Lorraine in 1948.

Mr. J. Symons, A.C.I.S., principal assistant in the Secretarial Department of the No. 3 (Oldham) Sub-Area of the North Western Electricity Board, has been appointed sub-area secretary of the No. 6 (Lakeland) Sub - Area in succession to **Mr. C. Kay,** who is retiring in June, 1956. Mr. Kay, who is a Fellow of the Corporation of Certified Secretaries, has been secretary of the Lakeland Sub-Area since nationalisation. Previously he had been secretary and commercial assistant with the Barrow Corporation Electricity Department after beginning his career with Vickers - Armstrongs, Ltd.

Mr. J. Symons

Mr. Symons was educated at the Grange High School, Bradford, and Bradford Technical College. He commenced his career with Bradford Corporation Electricity Department in 1928 and was appointed assistant chief consumers' clerk eight years later. On nationalisation he was appointed senior secretarial assistant with the No. 1 Sub-Area of the Yorkshire Electricity Board, later becoming senior assistant (administration). He went to Oldham in 1951.

Among the awards announced by the Iron and Steel Institute are the following:—Williams Prize for 1955 to **Mr. R. Wilcock** (Samuel Fox & Co., Ltd.), for his paper on "The Operation of a 60-ton Arc Furnace at Samuel Fox & Co., Ltd." Ablett prizes for 1955 to **Mr. W. Ernest** (Samuel Fox & Co.), for his paper on "Waste Heat Recovery related to the Generation of Electric Power," and to **Mr. S. R. Phelps** (Guest Keen & Nettlefolds, Ltd.), for his paper on "Flying Shears for Bars and Billets. Electrical Requirements."

The London Division of the **Central Electricity Authority** held its Parents' Day on Friday last when parents and friends of apprentices were received at the Apprentices' Training School, adjoining Bankside generating station. After a tour of inspection of the workshops and seeing some the metal work carried out by the apprentices, the visitors proceeded to the Institution of Electrical Engineers where Lady Self presented the prizes to the apprentices. Mr. W. Wilde, chief generation engineer (operation), presided, and Mr. G. W. Whitmell, apprentices training instructor, presented his report of the progress made at the school during the past year. Sir Henry Self (deputy chairman (administration) gave an inspiring address in which he emphasised the importance of the industry which the apprentices were entering and the great traditions which he hoped they would maintain.

Mr. J. Farmery, B.Sc.(Eng.), M.I.E.E., M.I.Mech.E., M.I.P.E., for seven years principal of Workington College of Further Education, Cumberland, last month took up the position of head of the Engineering Department of the Technical Correspondence School, Wellington, N.Z.

The annual dinner-dance of the North Metropolitan Branch of the **Electrical Industries Benevolent Association** was held at St. Albans on 20th

April under the chairmanship of Mr. C. R. Marshall. There were 170 people present, the guests being Sir Harold Bishop, the president of the Association, and Lady Bishop, with Mr. H. Senior Fothergill, the secretary, and Miss E. G. Fagent, the chief welfare officer. During the evening a number of prizes were distributed, and it is estimated that the amount which will be handed to the Association will be in excess of £100.

Mr. W. Moody, M.I.E.E., whose forthcoming retirement from the position of manager of the No. 5 (Wakefield) Sub-Area of the Yorkshire Electricity Board we briefly reported in our issue of 9th March, will have completed fifty years' service in the electrical industry. Mr. Moody served his apprenticeship at the Bradford Works of the Phœnix Dynamo Manufacturing Co., Ltd., which was later merged into the English Electric Co., Ltd., with which company he was later responsible for the conversion of textile mills and other industries from steam to electric power and the conversion of the Dick Kerr Works, Preston, from d.c. to a.c. operation. In 1928 Mr. Moody joined the staff of the Yorkshire Electric Power Co. and its associated companies as a sales engineer, becoming sales manager in 1935, which position he held until nationalisation in 1948 when he took up the position of manager at Wakefield with the Y.E.B.

Mr. W. Moody

Mr. N. P. Newman, chairman and managing director of Newman, Hender & Co., Ltd., ironfounders and valve manufacturers, Woodchester, Glos, has been re-elected as chairman of the Council of Ironfoundry Associations for a further year. Mr. Newman is also president of the Joint Iron Council.

Recently Mr. W. Glass, joint managing director of Johnson & Phillips, Ltd., presented silver cigarette boxes in commemoration of fifty years' service with the company to **Mr. A. E. Holmes,** foreman, rubber cable braiding shop, and **Mr. A. T. Hayward,** of the paper cable shop. Mr. Holmes joined the company in 1905 and Mr. Hayward in 1906. Mr. Glass was accompanied by Mr. Whitehead, Mr. Olley and Mr. Holliman. In addition, the company presented a cheque to Miss G. Jones, of the Cardiff branch, who retired on 16th April after forty-five years with the company.

Mr. F. N. Calver, M.B.E., engineer-in-charge at the B.B.C. Daventry transmitting station, retired on 30th April. He has been succeeded by **Mr. H. A. Masters,** previously assistant engineer-in-charge.

OBITUARY

Mr. J. Sayers, O.B.E., M.I.C.E., M.I.E.E., who was formerly with the London, Midland & Scottish Railway, died on 28th April, at the age of eighty-eight. Mr. Sayers was telegraph superintendent of the L.M.S. system from 1923 to 1929, and from 1929 until his retirement in 1934 was engaged on preparing a report for Sir Josiah Stamp on main line electrification.

Mr. Ernest Alexander Laidlaw, M.I.E.E., of Christchurch, Hants, died on 26th April, in his eighty-third year.

Mr. Francis Morley Ward, M.I.E.E., died on 25th April, at the age of seventy-five, at Hayes, Bromley, Kent.

Mr. G. P. Sutton.—The death has occurred of Mr. George Percy Sutton, who from 1948 until his retirement in 1950 was chief generation engineer (operation), British Electricity Authority, Midlands Division. After four years in the Birkenhead Corporation Electricity Department, Mr. Sutton went to Birmingham in 1906 and was appointed resident engineer at Hams Hall " A " station in 1933.

WILLS

Mr. G. W. Hodsman, A.M.I.E.E., constructional engineer for Bradford Corporation Electricity Department, 1920-48, and later progress engineer with the C.E.A., who died on 21st August last, left £3,998 gross (£3,865 net).

Mrs. Ethel Howarth, managing director of A. S. Howarth, Ltd., electricians, Rochdale, who died on 8th December, left £13,912 gross (£13,755 net).

Mr. J. A. Steeples, secretary of the Leicester Sub-Area of the East Midlands Electricity Board, who died on 10th December last, left £3,691 gross (£3,556 net).

Mr. A. S. Carr, M.A., M.I.E.E., former area engineer, G.P.O., North Western Region, who died on 15th December last, left £7,662 gross (£7,593 net).

E.D.A. Public Speaking Competition

The results of this year's national finals of the E.D.A. Public Speaking Competition, held at the Lighting Service Bureau, London, on 25th and 26th April, have been announced. For the first time the Yorkshire Electricity Board has won the men's Faraday Silver Challenge Shield, and the South of Scotland Electricity Board has the custody of the women's shield.

Miss Iris Haines (Lanarkshire Area) won the shield for the South of Scotland Board with an address on " The Influence of Television on Our Way of Life." Second place went to Miss Brenda M. Wright (Bolton District, North Western Electricity Board), who spoke on " Electricity in School Catering," with Mrs. Doreen V. Prescott (Bristol South District, South Western Board) third. Mrs. Prescott spoke on " Atomic Power."

Mr. F. R. Williams (Hull District, Yorkshire Electricity Board) was the winner in the men's section; he spoke on " Electricity—Its Influence on the Theatre." The runner-up (for the second consecutive year) was Mr. C. J. White (principal assistant, secretary's department, Board headquarters, South Eastern Board); Mr. White spoke on " Atomic Power." Third place went to the North of Scotland Hydro-Electric Board's representative, Mr. R. McKenzie (commercial assistant in the Dunoon District), who also spoke on " Atomic Power."

The judges for the men's contest were Mrs. Helen Key (Prestcold); Mr. K. Lockhart Smith (Film Producers Guild); Mr. V. A. H. Clements (C.E.A.) and Mr. Rex Palmer (ex-B.B.C. announcer). Mr. D. Bellamy (chairman, Yorkshire Electricity Board, and chairman of E.D.A.) presented the awards. Miss Vera Norvick (E.A.W.), Mr. F. A. Hoare (Merton Park Studios), Mr. Clements and Mr. Lionel Marson (B.B.C.) adjudicated the women's contest, and Mr. J. I. Bernard (E.D.A. chief technical officer) presented the awards.

Prize winners of the E.D.A. Public Speaking Competition. Left to right : Miss B. M. Wright, Mrs. D. V. Prescott and Miss I. Haines (winner of the women's shield). Mr. R. McKenzie, Mr. F. Williams (winner of the men's shield) and Mr. C. J. White

PARLIAMENTARY REPORT

Clean Air Bill

When the Clean Air Bill was debated on second reading in the House of Lords, Lord Amulree asked the Government to encourage more research into methods of removing sulphur from smoke.

The Bishop of Sheffield did not like what he called the evasive phrases "unsuitable fuel" and "as far as practicable." The new Clause about the height of chimneys was bedevilled by exemptions, he said. Why was Parliament so kind to the Central Electricity Authority? The Bill provided for full-scale national research into controlling emissions of chemical fumes and sulphur dioxide. Regarding Clause 6, which now required that furnaces burning more than one ton an hour (previously 10 tons) must have grit arresting plant, he considered that the figure was still too high. In Sheffield only two or three of the larger steelworks burned as much.

Lord Douglas of Barloch said that at Battersea Park grit and soot was being deposited at the rate of four ounces per square yard in a year. That was near to a quite modern power station. Where power stations were in the middle of urban areas the concentration of dust and dirt was becoming steadily greater, with extreme detriment to all those who lived in the vicinity.

The Earl of Munster, Minister without Portfolio, replying to the debate, said the Government believed that the problem of sulphur oxides, which were known to be injurious to health and also caused extensive material damage, was an intractable one and could not be dealt with by legislation. The Beaver Committee had recommended that the most efficient practical means of removing sulphur from flue gases should be adopted at all power stations in populated areas and the Minister of Fuel and Power had accepted this in principle. The plant at Bankside was regularly catching about 97½ per cent of the sulphur in the flue gases.

The Battersea and Bankside stations were the only ones in the world equipped for the removal of sulphur. The technique was of limited application not only because of its cost but also because of the large amount of water which was required and the large amount of liquid effluent discharged. There was a more promising method which had now been developed whereby the sulphur could be recovered in the form of sulphate of ammonia. The C.E.A. was installing a pilot plant in a power station for large-scale trials and it was nearing completion. It was hoped that it would be in operation in September. That would give the House an opportunity to see whether this new discovery would have the success desired.

The definition of "practicable" had been considerably tightened since the Bill was introduced but he would go into the matter again to see if a further improvement could be made.

Rural Rail Transport

In a debate in the Commons on rural transport Capt. Duncan said that in the recent report of the North of Scotland Hydro-Electric Board there was a suggestion that agreement had been reached with the railways to experiment with a battery rail-car in an area in Scotland, but had a battery rail-car been produced? Had it been ordered? He believed that the Hydro-Electric Board had offered very generous terms and was anxious to get this experiment launched, with a view, perhaps, to extending it to other areas and selling more electricity at off-peak times. He had the feeling that there was no real, positive drive by the Railways to do something.

Mr. Harold Watkinson, Minister of Transport, replying to the debate, said that in solving this problem the Sligo-type of tram vehicle was a "non-runner"; steam trains were replacing it for many operations. There was much more hope for the battery-operated light rail-car, particularly in Scotland where it would have the hydro-electric power to recharge its batteries. This vehicle, which weighed 25 tons, would have 12 tons of batteries in it, which caused difficult problems. However, he was glad to tell members that all the difficulties about design, etc., were now cleared away and the Commission was proceeding with the construction of at least one experimental vehicle, and perhaps more, in order that this very interesting idea could be tried out.

The ordinary diesel rail-cars now in operation had greatly increased traffic; a 70 to 100 per cent increase was not exceptional. But the cost was high—about £25,000 for a two-unit car. The Commission was to build 4,600 of them in order to see whether they would make some branch lines an economic proposition. He understood that each unit had to carry about 100 passengers to be profitable and that was a lot on some branch lines.

If there was any hope of making a railway into a tramway, he was only too willing to co-operate with the Commission. But when the Commission tried to sell its lines on the Isle of Wight it could not get a single bidder.

Scientific Literature

Mr. Callaghan asked the Chancellor of the Exchequer what funds he proposed to make available for the establishment of a National Reference Library of Science and a Lending Library, in view of the recent report of the Scientific Advisory Council.

Mr. Harold Macmillan said he was making £2,500 available during the current year for the purchase and binding of scientific periodicals as a beginning to the Lending Library. A sum of £10,350 had been included in the Estimates for the purchase of books and periodicals for the Patent Office Library which would eventually form the basis for the Reference Library.

Defective Wiring

Mr. Eric Fletcher asked the Minister of Housing and Local Government whether, as negotiations between the Metropolitan Boroughs Standing Joint Committee and the London Electricity Board for the introduction of an assisted wiring scheme had broken down, he would introduce legislation to meet the hardship suffered by tenants of premises where the electric wiring was defective and the landlord refused to cure the defect.

Mr. Sandys said it was not clear what change in the law Mr. Fletcher had in mind.

Mr. Mitchison said the practical hardship involved was that many tenants could not pay for the better wiring when it was needed.

Mr. Sandys said this did not indicate what reform Mr. Mitchison had in mind. Did he suggest that the landlords should pay, or was it to be the local authorities, the Exchequer or the Electricity Board?

Mr. Fletcher said he would give the Minister a detailed explanation of what he proposed.

Herbert Committee's Report

Mr. Palmer asked the Prime Minister if he was now able to make a statement about the Government's policy in relation to the report of the Select Committee on Nationalised Industries.

Sir Anthony Eden replied that a statement of the Government's policy on the report would be made before the Whitsun recess.

Asked by Mr. Grimond if, in view of recent developments in Government policy, an increased number of allotted days for debates on the nationalised industries would be reserved, Sir Anthony said that, as he had informed the House on 8th December, he did not think that to increase the number of days would provide the right answer to this particular problem.

Mr. Grimond said that now the nationalised industries were being financed directly from the Treasury it was all the more necessary that the House should have some control over

them. Some of their reports and activities had not been debated for years. If his suggestion was not acceptable would the Prime Minister set up a Standing Committee to watch over these industries?

Sir A. Eden: "That point is perfectly fair, and there is great force in it, but I suggest we should make known to the House our decision and then we can debate it."

Mr. J. Griffiths asked if he would consult the T.U.C. first before coming to a conclusion. The T.U.C. was vitally interested, because any change might affect the normal arrangements between the managements and the workers in the nationalised industries.

Sir Anthony Eden said the consultation should be with the House first. He was not going to do anything rough or revolutionary about this complicated and difficult matter.

Atomic Energy Authority

The Prime Minister declined a request from Mr. Warbey that he should arrange to transfer Ministerial control of the Atomic Energy Authority to a Minister sitting in the House of Commons.

Mr. Callaghan said that £30 million a year was being spent in this sphere and it would be worth considering some alteration in Ministerial arrangements so that the House could feel there was someone present who was responsible for some part of the money that was spent.

Sir Anthony Eden said he would consider the suggestion but he did not wish to see the creation of another Minister.

Aswan High Dam

Mr. Nutting informed Mr. Hugh Fraser that the Government had entered into the international negotiations for financing the Aswan High Dam because after careful study they believed the project to be technically sound and of great importance for the welfare of the Egyptian people.

Industrial Rating

The Industrial Rating Bill, which would have imposed full rates on industrial hereditaments, was defeated in the House of Commons. The issue was decided on party lines, the Government having a majority of 45. Mr. Enoch Powell, Parliamentary Secretary, Ministry of Housing and Local Government, said it would be wrong for Parliament to decide the future of industrial rating at a time when a comprehensive review was being made of local government financing generally. The Government planned to begin consultations with local authority representatives in the autumn and to announce their conclusions before the end of the year.

Ex-Company Pensioners

Mr. Palmer asked the Minister of Fuel and Power if he would make available details of the pension increases now approved by him for ex-company pensioners in the electricity and gas industries and whether he intended to give these increases retrospective effect as from 1st April, 1954.

Mr. David Renton said the Minister had agreed that the gas industry's proposals should take effect from 1st April, 1956, and was still considering this aspect of the electricity industry's proposals.

Capital Investments of Nationalised Industries

Mr. Nabarro asked the Minister of Fuel and Power whether he would state the annual capital investment sums expended by the coal, gas, and electricity industries during the period 1950 to 1955, and the sums authorised for the years 1956 and 1957.

Mr. David Renton gave the following figures:—

Coal		Gas		Electricity*
		£ million		
1950	79	1950/51	36	129
1951	32	1951/52	45	142
1952	49	1952/53	46	154
1953	79	1953/54	50	170
1954	100	1954/55	55	203
1955†	95	1955/56	61	199
1956‡	107	1956/57	52	195

*Central Electricity Authority (British Electricity Authority before 1st April, 1955) and Area Electricity Boards. †Provisional. ‡Sums authorised.

Restrictive Trade Practices Bill

When the Commons considered the Restrictive Trade Practices Bill in committee a group of amendments was proposed which would have extended the range of agreements to be registered and considered by the Restrictive Practices Court to include agreements irrespective of whether the restrictions accepted by the parties were "mutual" or not.

Mr. Peter Thorneycroft, President of the Board of Trade, replying to the debate, said that unless Parliament put into Clause 5 (Registration of Agreements) the idea of mutuality it would cover almost everything in commerce: prices to be charged, terms and conditions to be applied, quantities and descriptions, and processes of manufacture. It would make chaos of the Bill.

Mr. Robert Edwards complained that the Bill would do nothing to eliminate unwritten restrictive agreements. He said the Co-operative movement was denied the right to sell a whole range of electrical appliances but there was no written statement of the agreement not to supply the goods which could be registered.

Other members referred to restrictive agreements reached by corporations in this country with companies abroad. Mr. Thorneycroft said that under an amendment which the Government would move later such agreements, which were of the normal cartel type, would be registrable under the Bill.

On another point, he said that if a group of producers came to an arrangement, and there was no reciprocal agreement between them and the suppliers, that would not mean that the producers' ring would not be registrable.

The amendments were negatived.

An amendment was moved by Captain Orr to the section dealing with restrictive quota agreements. He proposed that payments made by way of subscription to any fund to be used exclusively for purposes of industrial or scientific research, or towards the administrative expenses of a trade association, should be excluded from the operation of this section.

Mr. Walker-Smith, Parliamentary Secretary, Board of Trade, said it was not the Government's intention to catch such arrangements, which were not restrictive, and they would accept the amendment. This was agreed to.

Mr. Thorneycroft moved an amendment to ensure that persons who were carrying on business and entering into restrictive arrangements could not avoid the provisions of Clause 5 by operating through a trade association. The second defect in the Clause was that agreements entered into by associations, the members of which were not in the firms carrying on business in the production, supply or processing of goods, but were merely representatives nominated by such persons, would escape. That was an obvious loophole which the amendment with three others would close. The amendments were agreed to.

Mr. Basil Nield moved an amendment to ascertain whether, when a trade association agreed upon a restrictive practice and it was adopted in spite of some members of the association refusing to sign or agree, the practice would be deemed to be accepted by all the members.

Mr. Thorneycroft said that whatever the position of the persons who were not parties to the arrangement, the fact was that this was a registrable agreement. Whether such persons should be open to opprobrium or whether they had a complete defence could be argued on another Clause. The amendment was withdrawn.

An amendment to alter the section dealing with "recommendations (whether express or implied)" so that it referred to "specific recommendations" made by or on behalf of an association was agreed to. Accepting it, Mr. Thorneycroft said that one of the methods used by associations was to send round a price list, and to say nothing about it, but everyone agreed to stick to those prices. In his submission a specific recommendation was implied there. He did not want to leave a loophole for the small number of people who could get around the provisions of the Bill by simply circulating a price list or telling a third party rather than a member of the association. It was not intended that a vague, general recommendation should be caught by the Clause.

The committee stage debate was adjourned.

INDUSTRY AND THE HOUSE

Comments on the Budget Proposals

By A. M. F. PALMER, A.M.I.E.E., M.P.

BUDGET Day has always been an important occasion in the life of a House of Commons as Mr. Harold Macmillan was at some pains to remind us. He said that "very many years" had passed since he first heard a Chancellor of the Exchequer open a Budget. That was when he first entered the House and the Chancellor of the Exchequer was the Member for Epping. Sir Winston Churchill, now the Member for Woodford, sat beneath the gangway to hear this reverent tribute to his mid-career activities at the Treasury. Members were tight-packed as usual on the green benches. To show that old customs linger on in unexpected places Mr. Nabarro and Mr. Thornton-Kemsley sported traditional black toppers worn well down over the eyes. The Chancellor of the Exchequer seemed a little tense at the start of his long speech, but once warmed up he was fully master of the day.

He admitted candidly that 1955 ought to have been a good year, for the flow of dollars from the U.S.A. to the rest of the world had continued abundantly. Output was growing rapidly in all major industrial countries and trade between them was increasing at an exceptional rate. The primary producing countries in general remained prosperous and had provided receptive markets for manufactured goods. Everything in a sense, therefore, had seemed in our favour, yet the country's financial reserves which stood at £813 million, were insufficient for these represented only about 8 per cent of the annual turnover of the sterling area trade with the non-sterling world. Whether the figure for this year or the figure for last year was taken, the country was trading beyond its capital resources. We lacked just that amount of extra strength to allow "swings in the balance of payments" to be taken with comfort. Hence, said the Chancellor, the reserves must be increased. Success here would mean that the rest would follow.

Mr. Macmillan went on to contend that 1955 had been a year of great prosperity for the ordinary man and woman. Everyone had a job, personal consumption continued to rise and investment had increased. Although this was very good it was not good enough. Prices were still rising; there was shortage of labour and some shortage of materials. Imports had increased while exports were held back from foreign markets and consumed at home. British industrial productivity in 1955 had fallen as against 1954.

Need to Increase Savings

After thus summarising the economic position of the country Mr. Macmillan moved to outline the changes of direction he proposed. His main lead was the new emphasis to be given to the need for saving. As the Chancellor saw it, the country must now move "right into the front line with new objectives and equipped with new ideas and new weapons." The most powerful weapon turned out to be the premium bond scheme, which to a rather sceptical House he claimed was not "a pool or a lottery." The investor would never lose his money but would simply forego interest in return for the chance of winning a tax-free prize. In a phrase which deserves full marks, Mr. Macmillan said it would be an encouragement to saving "by those members of the community who were not attracted by the reward of interest, but did respond to the incentive of fortune." Other minor weapons in the savings battle were the issue of certificates at 15s with a value of 20s after seven years and defence bonds at 4½ instead of 4 per cent. Savings Bank deposits in future are to have the first £15 of interest exempted from income tax.

All the foregoing will undoubtedly receive the support of industry, which understands well enough that new capital developments can in the long run be financed only from saving if inflation is to be restrained. But I doubt if industry will look quite so kindly on Mr. Macmillan's attempt to maintain the middle way by increasing the profits tax by 2½ per cent to 30 per cent (distributed) and ½ per cent to 3 per cent (undistributed).

How did the House as a whole receive the Budget? This is a difficult question to answer because the truth is, I think, that this Budget is not easy to like or dislike; it does not arouse passions. Whatever controversy possible will come at the more detailed points in the Finance Bill discussions. Conservatives, of course, like the emphasis on savings and in the main have no ethical objection to the premium bond scheme. They are very disappointed, however, that Mr. Macmillan had not reduced direct taxation on the middle range incomes.

Views of the Opposition

Labour Members contend that the Budget continues to move the country's finances in the wrong direction because here and there it deliberately increases prices once again. While Socialists appreciate as much as Tories that saving is fundamental to future prosperity, many Labour Members dislike for religious and ethical reasons the idea that "Monte Carlo methods"—as they say—should be used to finance the revenue.

Mr. Harold Wilson made the main Opposition speech in criticism of the Budget. Apart from a brief commentary on Budget Day Mr. Gaitskell did not seriously intervene, which was perhaps a pity. Ordinarily, he might have been expected to wind up the last day of the debate, but was occupied elsewhere in what turned out to be later a rollicking exchange with Messrs. Bulganin and Krushchev of Russia. Another former Chancellor, Mr. Hugh Dalton, took his place and added to the liveliness of the House by a speech that recalled the brave days of cheap money and magnificent optimism. I must confess that Mr. Macmillan made a very adequate reply: his was a fine parliamentary performance which has done much since to raise the spirits of Government supporters.

I will not go into the surprising decision to meet the capital requirements of the nationalised industries for two years out of the Exchequer surplus because this, I understand, is to be discussed elsewhere in the columns of the *Electrical Review*. Sufficient to say that the change, although strange in a sense coming from a Conservative Government, should make for simplification and not be so inflationary in effect as previous methods. Is it likely to court the risk of increased Treasury supervision of nationalisation? It is hard to say at the moment, but we may be wiser when the Government delivers its promised pronouncement on the report of the Select Committee on nationalised industries.

EXPORTS TO THE U.S.S.R.

Board of Trade Statement

The communiqué issued by the Foreign Office at the conclusion of the discussions between the Prime Minister and Mr. Bulganin and Mr. Khruschev referred to a list of machinery, equipment and ships submitted by the Soviet representatives (see page 732). The Board of Trade has now completed its examination of the list from the point of view of strategic controls. The following is the position as regards electrical and allied equipment. The quantities mentioned in the Russian list are given in parentheses:—

Not affected by the strategic export controls.—Power trains with gas turbines of 5,000 kW (10-20 units); high frequency electric furnaces (90-120 million roubles); electric steel smelting furnaces for 70-200 tons with magnetic stirring (six units).

Goods subject to embargo.—Extrusion presses, 15-25 thousand tons capacity (two units); complete rolling mills (120-150 thousand tons).

Goods, some types only of which are subject to embargo.—Steam and water high and ultra-high pressure valves with remote control (23 million roubles); equipment for the manufacture of radio valves, lamps, luminescent tubes and transistors (75-100 million roubles); radio and television equipment, measuring and control devices, communication equipment and instruments for the automatic control of technological processes (80-100 million roubles).

Exports subject to quantitative restriction.—Stationary gas turbines of 20,000-30,000 h.p. (20-30 units).

Goods about which further information is needed.—Vacuum electric furnaces for smelting ferrous and non-ferrous metals (100 units); complete equipment for manufacturing radio apparatus using printed circuits (50-75 million roubles); and laboratory equipment (10 million roubles).

Details of the United Kingdom security export controls were published in the *Board of Trade Journal* on 16th October, 1954, and 20th August, 1955.

INDIAN INDUSTRIAL POLICY

The Delhi correspondent of *The Times* reports that on 30th April Mr. Nehru made a statement in Parliament on the Indian Government's revised industrial policy. The Prime Minister said that the State would progressively assume a predominant and direct responsibility for setting up new industrial undertakings, and for the development of transport facilities. It would also undertake trading on an increasing scale.

The new resolution, which replaces that of April, 1948, divides the industries into three classes: Those in which future development will be the exclusive responsibility of the State; those which will be progressively State-owned, and in which the State will therefore generally take the initiative in establishing new undertakings, but in which private enterprise will also be expected to supplement the effort of the State; and all remaining industries, whose future development will in general be left to the initiative and enterprise of the private sector.

Industries listed in the first class include atomic energy; iron and steel; heavy castings and forgings of iron and steel; heavy plant and machinery required for iron and steel production; heavy electrical plant, including large hydraulic and steam turbines; minerals specified in the schedule to the Atomic Energy (Control of Production and Use) Order, 1953; telephones and telephone cables, telegraph and radio apparatus (excluding radio receiving sets); and generation and distribution of electricity.

ELECTRICAL USES OF ALUMINIUM

There has recently become manifest a great increase in the use of aluminium for electrical conductors in the generation, transmission and distribution of electrical power; looking back over the last five years the tonnage of aluminium consumed by the electrical trades has nearly doubled. This increase was very marked during 1955, and was stimulated by the sharp rise in copper prices. At the same time it must not be overlooked that more copper than ever is being used for electrical purposes and in fact there is ample scope for both materials, each in their right place.

Although aluminium is already proving to be a very suitable material for some of the newer applications, e.g. insulated power cables, where it gives real promise of enabling some substantial reductions in first cost to be achieved, there are other applications, e.g. transformers, in connection with which the technical and economic advantages can only be determined by experiment.

Because of the pronounced interest now being shown in the technical aspects of aluminium usage the Aluminium Development Association is planning a two-day symposium on Electrical Engineering Applications of Aluminium, to be held in the spring of 1957. Its purpose will be to give an opportunity for both formal and informal discussion on aluminium uses, as did the very successful conference on the Electrical Utilisation of Aluminium sponsored by the American Institute of Electrical Engineers in March, 1955. It is hoped that papers will be presented by electrical engineers who have already had experience in the manufacture, installation and operation of equipment using aluminium conductors: there will also be papers describing the considerable use of aluminium castings and wrought products for components and structures associated with electrical machinery, and a paper on the economic aspects. The symposium will be open to all interested in this subject.

PRICES OF MATERIALS

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £189 0s 0d
COPPER, H.C. Electro	ton £343 10s 0d
Fire Refined 99·70%	ton £342 0s 0d
Fire Refined 99·50%	ton £341 0s 0d
COPPER Tubes ..	lb 3s 4½d
Sheet	ton £421 15s 0d
H.C. wire and strip ..	ton £391 10s 0d
LEAD, English ..	ton £112 5s 0d
Foreign	ton £111 0s 0d
MERCURY	flask £85 0s 0d
TIN, block (English) ..	ton £750 10s 0d
ZINC, G.O.B. Foreign	ton £97 5s 0d
Electrolytic	ton —
BRASS TUBES (solid drawn)	lb 2s 8½d
Sheet	ton £332 10s 0d
Wire	lb 3s 4½d
PHOSPHOR BRONZE Wire	lb 4s 11½d
PLATINUM	oz £34 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 26½d—26⅝d

A reduction of £35 a ton to £350 c.i.f. United Kingdom for electrolytic copper wire bars is announced by the Rhodesian Selection Trust. This is the first reduction since the Trust decided to stabilise the price for its copper for given periods in May, 1955.

Siemens Arrangements

In order to facilitate administration within the Siemens-Ediswan Group the trading activities and staff of Siemens Electric Lamps & Supplies, Ltd., are being taken over as from 1st June by the parent company, Siemens Bros. & Co., Ltd. The parent company has undertaken to accept and discharge the liabilities of Siemens Electric Lamps & Supplies outstanding at 1st June. From that date all orders, inquiries, etc., for the lamp company should be addressed to Siemens Bros. & Co., but at the same address as hitherto.

Control of Hiring

The Board of Trade has made an Order (S.I. 1956/626), coming into force on 27th April, to amend the Control of Hiring Order, 1956. It provides that the term "rental" includes any payment, howsoever payable, made wholly or partly for the possession or use of controlled goods, and requires that the total amount of rentals payable under a hiring agreement shall be ascertainable at the date of the signing of the agreement.

A PROGRESSIVE INDUSTRY

Confidence Expressed at E.D.A. Luncheon

THE remarkable increase in the numbers of consumers of electricity in the last 35 years was emphasised by Viscount Chandos, president of the British Electrical Development Association, when replying to the toast, "Electrical Development," at the Association's annual luncheon at the Savoy Hotel, London, on 24th April, briefly reported in our last issue. He said that in 1919, which marked the birth of E.D.A., there were only 70,000 consumers of electricity in this country; to-day there were over 15 million. Moreover, the last twenty or thirty years had seen the development of domestic electrical equipment which had come to be regarded as essential in the home.

"As we sit here," he said, "13 million electric irons are waiting to be used when the housewife can tear herself away from her television set; 7½ million vacuum cleaners are straining at the leash to produce that hygienic whine which, with bird song, is the first sign of daybreak in 1956; and 3 million electric washing machines are prepared to enter into competition with steam laundries."

Lord Chandos said that the new uses for electricity which were just around the corner made it clear that the industry would require re-doubled efforts in research and development. London would not have clean air without the substitution of electricity for the "fossil" fuels, for instance. Most people engaged in the industry believed that the tendency for the demand for electrical energy to double itself every ten years was likely to continue, perhaps at a greater rate, during the next ten years. He had every confidence in the industry and his confidence was in some part based on his confidence in E.D.A.

The toast had been proposed by Sir John Maud, Permanent Secretary of the Ministry of Fuel and Power, who said that the response of the electricity supply industry to the Government's request for restraint in investment had assisted the Chancellor of the Exchequer in his Budget. The industry had capital requirements of £200 million this year, but they had been selective and had been careful, in reducing capital requirements, not to damage any one part of their concern more than they ought. For example, he said, rural electrification had not been unduly cut back and they still wanted farmers to use a great deal more electricity.

Mr. Emanuel Shinwell, M.P., replied to the toast, "Our Guests," proposed by Viscount Chandos. The guests included the Chancellor of the Exchequer (Mr. Harold Macmillan), the Minister of Supply (Mr. Reginald Maudling) and the Minister of Health (Mr. R. H. Turton). Mr. Shinwell said he had recently told Mr. Malenkov that, during the period of the Labour Government, he had nationalised the electricity supply industry. "It made no impact on his mind at all," Mr. Shinwell said, "but when I told him that I had been both Secretary of State for War and Minister of Defence, he became suddenly alive. That was right up his street!"

Commenting on the search for Government economies, Mr. Shinwell said he had recently suggested the abolition of the Ministry of Supply and several other Government Departments could be abolished without harm being done. We could get on just the same.

Despite all criticism, this was still a great and magnificent country. We had encountered great difficulties in various parts of the world but we would survive those difficulties, as we had always done.

Mr. Shinwell said that once an industry had been nationalised, it was wise for all concerned to make the best of it and to ensure its progress and prosperity in the interests of all. The progress of the country, industrially, would in the future be conditioned by our ability to produce more and more power, and in his opinion the electricity supply industry was perhaps the most important industry of all.

Left: Mr. H. J. Randall, Lord Hurcomb and Mr. Harold Macmillan. Right: Sir John Maud, Mr. R. Maudling and Viscount Chandos

Sir John Maud, Mr. D. Bellamy, Sir Edward Bridges, Mr. E. Shinwell, Mr. J. Henderson Stewart and Mr. W. S. Lewis

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Copper versus Aluminium

I WAS interested to note the editorial comments in the *Electrical Review* of 13th April under the above heading. As a matter of principle, I generally leave this sort of bait alone since rising to it is apt to lead to contentious and unprofitable argument when the subject involved is as complex as the one which you seek to review. Nevertheless, I think that this does present an excellent opportunity to dispel the poorly founded suggestion that there is necessarily any direct conflict between copper and aluminium such as your editorial might suggest.

The fact is that aluminium and copper has each its proper place in the electrical industry and, as far as I can see after some years of careful study of the growth of the electrical industry and of the relative prospect of supply of copper and aluminium, over the next ten years electrical engineers are going to need just about as much of both metals as they are likely to be able to obtain. The question which should exercise the electrical engineer's mind is, therefore, simply where to use aluminium to the best advantage and where to use copper. This decision is made difficult for the average engineer partly through his frequently limited knowledge of the technology of aluminium and its alloys, and also through a good deal of prejudice born of misinformation, or misuse.

Amongst the misconceptions that mislead the engineer is your own suggestion that " by virtue of its superior conductance copper must continue to be superior in electrical performance." This, of course, is a complete *non sequitur* and is true only in the special cases where space is an important factor *per se* or in relation to its influence upon the relative size of a piece of electrical equipment which, in turn, may reflect upon its cost.

A cursory study of published reports will show that there is almost no type of electrical equipment involving any significant tonnage of conductor material that has not been manufactured using aluminium and where the aluminium has not given entirely satisfactory performance within its designed capacity. Moreover, this has been achieved without the introduction of any material manufacturing difficulties. It follows from this that the question of whether aluminium or copper should be used in any piece of electrical equipment falls to be decided in the vast majority of cases only upon the relative overall economics of the two. It is this question of economics which has caused aluminium to be used now almost exclusively in overhead transmission and distribution systems, and not any serious consideration of the low weight of aluminium. Indeed, the average steel-cored aluminium conductor is not always very much lighter than its copper equivalent (although it may be considerably stronger). The significant factor is that it is somewhere around half the price.

This same consideration of price affects every other application. Aluminium has roughly two-thirds the conductivity of copper and one-third the density, so that electrically one can say that one ton of copper can generally be replaced by about half a ton of aluminium. At to-day's prices one ton of copper costs around four times as much as the half a ton of aluminium which would replace it electrically.

Nevertheless, this enormous price advantage for aluminium is not unqualified since, as I have said before, there is the space factor to contend with. In many classes of electrical equipment the extra space which aluminium would require compared with copper enlarges the equipment as a whole. In extreme cases the position may be reached in which the saving which might accrue from replacing copper with aluminium would be not only cancelled out but turned to a loss by the consequent increase of other materials needed by the general increase in size. One must also remember that a manufacturer will not change equipment designs to use a new material unless there is a substantial incentive, be it technical or economic. If economic, the advantage must be large enough to amortise within a reasonable period the development, design, tooling and selling costs of the new model.

It follows naturally from this that aluminium tends first to be used in those applications where it shows the greatest economic advantage and these are naturally the ones where its less attractive space factor does not carry heavy penalties. The most obvious of these are overhead transmission conductors and busbars, followed very closely by insulated power distribution cables.

In this latter field the use of aluminium is growing very rapidly all over the world. The trend is somewhat restrained by the inability, for the moment, of the aluminium supply to catch up with the demand, and in surprisingly large numbers of cases by a bizarre " conservatism " amongst some engineers who feel that an aluminium cable is a new-fangled idea which should be avoided as long as possible. A quick study of the available literature would convince these people that aluminium insulated cables have been in continuous satisfactory service since the early part of the century and if anyone still seriously questions that aluminium cables can be jointed about as easily as copper I should be happy to have him disabused of that idea.

Much as we, in the aluminium industry, like our favourite metal, we would certainly be very hesitant about backing the suggestion " that aluminium lends itself to simpler and cheaper manufacturing processes." This might have been true in 1910 but, except in rather isolated cases, I think that it would not be true now. The material is a quarter the price of copper, but I would put the process cost per piece generally about the same. The use of aluminium in the years immediately ahead will be decided upon its economics. The reason why, in the decades between around 1915 and 1945, aluminium was little used in the electrical engineering industry, beyond overhead transmission systems, was simply that with that single exception economic considerations caused aluminium to be sold for other more lucrative purposes.

I said " in the years immediately ahead " because in the more distant future an entirely new factor will govern the relative uses of copper and aluminium. As far as we can see, the available annual world supply of copper cannot increase by any large factor in the period ahead except at very high price levels, whereas the production of aluminium can and will continue to grow at its present meteoric rate. Now the electrical industry is at present, and is likely to continue, doubling itself about every seven or ten years, and each doubling will unquestionably call for a corresponding doubling of the consumption of conductor material. If, over the next ten years, the copper

supply is unlikely to increase significantly, then it follows that the entire balance corresponding to the doubling of electrical demand will have to be made up by some other material. The only other commercial conductor material is aluminium, and we are left with the inescapable proposition that within ten years from now half of all the conductor material used in the electrical industry must be aluminium whether we like it or not, and almost regardless of the relative prices of copper and aluminium.

Now I think that I can leave some statistician to work out how much aluminium will, therefore, be used in the electrical industry ten years from now, but of this we can be assured, that the production of that extra quantity of aluminium is going to set the aluminium industry quite a problem when considered alongside the rapidly growing demands in other industries. Still greater quantities would be required before aluminium could make substantial inroads into the markets now held by copper. And there, I think, we are more or less back where we came in. I hope that this may have done something to convince your readers of some of the reasons why many of us in the aluminium industry who are closely concerned with this problem do not see it as one of conflict with copper but a problem of intelligent complementary usage. The important thing, as we see it, is that electrical engineers and manufacturers should clearly understand the position and cater for it accordingly.

To my mind this would involve on the one hand a steady transition from copper to aluminium in those applications where aluminium shows substantial price advantages (and the most obvious of these at the moment is insulated cables), and, at the same time, a programme of long-term development sufficient to ensure that, as increasing demands for conductor material make it necessary, sufficient practical experience exists of the manufacture of aluminium wound electrical machinery to ensure that the change-over can be made with absolute confidence both by manufacturers and by users.

Programmes of this kind are already in hand in countries overseas. In America several of the largest electrical equipment manufacturers are actually undertaking series production of such equipment as distribution transformers and small motors up to a certain percentage of their total output, although the introduction of aluminium units could scarcely be justified on the basis of immediate commercial considerations. This is surely sufficient testimony to the fact that the confusion of which you speak is not incapable of resolution. The best treatment for the condition is the elimination of all unsubstantiated fancies by a few small doses of sound practical experience.

London, W.C.2. STANLEY F. PRICE,
Aluminium Union, Ltd.

[Lest any reader should get the impression from the above letter that our leaderette was intended to "take sides" we emphasise strongly that this was certainly not the case; it was a sincere attempt to arrive at the real truth of the position.—Editors, *Electrical Review*.]

British Railways' Shortcomings

BECAUSE my interests also are bound up with the increasing use of electricity, I congratulate "Reflector" on finding my letter regarding British Railways in the *Manchester Guardian* and still more, on turning it into an argument for the electrification of railways (your issue of 20th April).

In the letter, which was written in a moment of exasperation, I explained that for a quarter of a century I had travelled 25,000 miles a year on British Railways, and that as a result of travelling by rail in six countries during the last twelve months, I had realised with some surprise that Britain came a long way last as regards passenger comfort and train punctuality. I blamed it on management and lack of competition and notwithstanding "Reflector's" persuasive prose, I still feel that management and competition have a lot to do with efficiency.

I have many friends in the top management of British Railways; they are efficient, and they are also exasperated. They are finding it difficult to get efficiency out of a staff who are all virtually Government employees, and it is, of course, hard to whip up enthusiasm and loyalty for any Government when the country is not at war. The difficulty of managing such an incredibly large undertaking coupled with a complete lack of competition makes it difficult to see how we can expect other than a second-class service.

The other five countries in which I travelled by rail last year were Holland, Germany, Switzerland, India and Malaya. Competition in Holland and Germany is supplied by excellent roads, and in India and Malaya by first-class internal air services. All the trains in which I travelled were prompt and all the coaches cleaner and more comfortable. In only one country, Switzerland, were the trains electric.

I, of course, agree with "Reflector" that electric trains run more promptly in this country, but the comfort of the traveller is nothing to what it was in the old steam coaches of thirty years ago—the coaches seem to run more roughly on the track, and the passengers' seats are considerably narrower in each direction. This, obviously, is with a view to carrying more passengers in a lighter coach thus cutting down engine sizes per passenger carried. But I have not noticed any corresponding reduction in season ticket rates.

Manchester, 5. THOMAS ATHERTON.

Uganda's Future Load

IN the comment in the *Electrical Review* of 13th April on the Uganda Electricity Board's 1955 annual report it is stated that

> "Proposals to start construction of further hydro-electric works on the Nile, below Owen Falls, as early as 1960, appear to be unduly optimistic about the growth of load. The report refers to the possibility of transmitting as much as 45 MW to Kenya by the 132 kV line just completed but one may justifiably wonder how long such a load will take to develop, when the present maximum demand in the three principal areas of Western Kenya is just 2,000 kW. The Nairobi area could certainly take more but it must be remembered that the distance from Owen Falls is 400 miles, a long way at 132 kV."

The Kenya supply is more than a possibility. There is a signed agreement, as stated in the report, to supply electricity to the Kenya Power Company. This company was formed to construct a transmission line from the Uganda border to Nairobi and to take over the generating stations in Nairobi, and it is to Nairobi that the bulk of the Uganda supply will be transmitted. Construction on the Uganda section of the line is completed, as mentioned in the report, and construction on the Kenya section of the line has already started. The Kenya Power Company has undertaken to take 30 MW by 1964 and the indications are that it will be nearer 45 MW by then. The route length of transmission line between Owen Falls and Nairobi is under 330 miles, and not 400 miles.

In addition to this Kenya bulk supply, there are at Jinja, at the very source of power, a copper smelter due for commissioning this year and a new textile factory already operating with its installation of large capacity electrode boilers. These two factories will take time to reach full production but the generating plant is fortunately in com-

mission to deal with the load. Other projects are planned and there is a great deal of potential load not yet connected: for example, of the 150 cotton ginneries in Uganda, just over twenty have so far been connected. There are also coffee and tea factories; the cement works are putting in plant to treble their output; and there is a growing awareness among the local population of the advantages and benefits of an electricity supply. The distribution schemes now approved and under consideration are designed to satisfy the demands of the new consumers.

Your readers will know that it is common all over the world for electricity undertakings to underestimate not only growth of load but also the time taken to install plant, resulting in a struggle to maintain full supplies. If construction of a new project starts in Uganda in 1960, it will be 1965 before it is in commission. Nine years is a long time and with the rapid developments now going on in East Africa the question is more likely to be: "Will the new scheme be ready in time?"

Kampala, Uganda. W. D. D. FENTON,
Chairman,
Uganda Electricity Board.

Off-Peak Heating

IN your issue of 20th April, reviewing the Factory Exhibition, you deplore the lack of publicity given to electricity for water heating, space heating and cooking, and we agree with you wholeheartedly.

We would, however, like to point out that we, as originators and the only specialists in off-peak unit storage heating, did our best to keep the flag flying and did, in fact, have a stand devoted entirely to off-peak heating, a fact which we regret seems to have gone unnoticed by your reporter, but not by visitors to the exhibition, from whom we have received a large volume of inquiries.

London, S.W.1. E. C. GREEN,
Manager,
Thermodare (Great Britain).

Engineers and Society

AT a joint meeting of the Institutions of Civil, Mechanical and Electrical Engineers in London on 27th April, the second Graham Clark Lecture was delivered by Sir Maurice Bowra, Warden of Wadham College, Oxford. For his subject Sir Maurice chose the impact of engineering on society and said that almost every society of which we knew anything practised engineering to some degree. However, it was only during the last hundred years or so that society had really become mechanised on a large scale. A considerable degree of civilisation could be secured with a minimum of engineering and although we must admit that without engineering civilisation was impossible, it was not always of first importance.

The engineer worked within his own social frame, and as the modern world was organised into national states, his work had to be shaped to suit them and their demands. Within these limits his work was a strong stabilising influence. A society which had become accustomed to seeing its life improved by many inventions would develop a rational approach to its problems, realise that stability was something almost beyond price and be very cautious about losing it. While the engineers laboured to make life easier and more agreeable, the mass of men accepted their contribution for a time and then, in wild frenzies of unreason, rejected it and destroyed it. For this Sir Maurice could see no cure.

One of the charges against the influence of engineering was that it interfered with the variety of the individual self and shaped it to a uniform mould by imposing certain patterns on it through modern organs of indoctrination such as the Press, cinema, radio and television. Some historians maintained that civilisation became degraded as soon as the cultivated tastes of a few were shared by many. It had even been claimed that this was one of the main factors in the decline of the Roman Empire. This certainly was not true, nor was the theory true of modern times. Man's unique position in the scheme of things lay in his ability to turn nature to his own needs, and if he really knew what these needs were, he should be able to do on a very extended scale what he had already begun to do with such imagination, devotion and skill.

Mr. W. M. Wallace, President of the Institution of Civil Engineers, proposed a vote of thanks to Sir Maurice for his paper, and this was seconded by Mr. T. A. Crowe, President of the Institution of Mechanical Engineers.

Instrument Company's 75 Years

LAST week the Cambridge Instrument Co., Ltd., celebrated the 75th year since its formation with two open days, intended primarily for university students and staff to see something of the works and the way in which precision instruments are made. An interesting brochure has been issued to commemorate the event.

The company was founded by Sir Horace Darwin, younger son of the famous biologist, originally to make the instruments found to be required for certain university work. After studying under Clerk Maxwell he applied kinematic theory to all the instruments which he devised, and was able to produce rapid advances on anything hitherto known. Some of the instruments produced in 1885 are still made to-day only slightly modified—a wonderful tribute.

It was in the field of temperature measurement that some of the best known work was done, including the manufacture of the Callendar's recorder, and the thread recorder devised by Darwin as a cheaper means of construction. This consisted of a galvanometer, actuated for temperature measurement by a thermocouple, so arranged that the end of the pointer was periodically depressed on to an ink impregnated thread, which then touched the rotating chart. Thus the galvanometer pointer was not subject to friction while taking up its reading. This device is fundamentally the same to-day.

Other outstanding work was in the sphere of electrocardiography and at the present time much development is going on in this sphere of activity, a number of specialised electronic equipments being on view at the works. Radiation pyrometers, pH meters and gas analysis apparatus were other pioneer activities, in addition to the Duddell oscillograph, first marketed by this company.

A recent development is a range of transducers using a photoelectric cell giving an output proportional to the angular deflection of a mirror, and a diaphragm unit which converts the quantity (usually pressure) being measured, into the angular movement of the mirror. These are intended for use in blood manometry. Another equipment of interest seen was an indicator unit for welding research. This is arranged to give continuous records of temperature, welding current and strain, at the point of welding.

Quite recently the company initiated a "soldering school" on its premises, with a full-time instructor. Here all new recruits spend a period ranging from a few days to a fortnight or so, and have to achieve a definite standard in the making of routine soldered joints, being instructed in a definite soldering technique applied on all the company's products. So important are soldered connections these days that this seems a very sound idea. The older employees of the company are also spending a short while in the school, a few at a time, but the changing of methods acquired over the years is not easy.

Locomotives for Steelworks

Rolls Royce/B.T.H. Diesel-Electric Equipment

AT the Scunthorpe works of the Appelby-Frodingham Steel Co., Ltd., last week we saw a series of demonstrations of the latest addition to the range of locomotives made by the Yorkshire Engine Co., Ltd. This diesel-electric shunting locomotive is primarily intended for steelworks and heavy industrial use, and was developed in conjunction with the British Thomson-Houston Co., Ltd. It is being produced in 200 h.p. and 400 h.p. types, both locomotives being fitted with Rolls Royce diesel engines and B.T.H. electric transmission equipment. The two locomotives are complementary in that the equipment of the 400 h.p. model merely duplicates that of the less powerful locomotive, i.e. there are two 200 h.p. diesel engines instead of one.

By adopting the comparatively new Rolls Royce six-cylinder 200 h.p. 1,800 r.p.m. oil engine, which is in the automotive range, this "Janus" locomotive is provided with an engine generator set much smaller than is usually the case with installations of this power rating. This has important implications in that it reduces both first cost and maintenance, and enables a smaller bonnet to be fitted, thereby improving visibility from the cab.

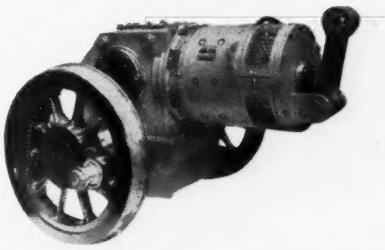
The 400 h.p. locomotive is usually built as a 0-6-0 type for any gauge from metre to 5ft 6in with reduction gear suitable for railway or industrial shunting requirements. Leading particulars of the locomotive are as follows:—

Weight	48 tons
Tractive effort at start	30,000 lb
Speed at continuous rating	8 m.p.h.
Tractive effort at continuous rating	13,100 lb
Maximum permissible speed	23 m.p.h.
Oil engines: super-charged Rolls Royce	Two
Diesel engine rating at 1,800 r.p.m.	400 h.p.
Gear ratio	22·85 : 1
Wheel base	11ft
Wheel diameter	3ft 8in
Can negotiate curves	120ft radius
Brake equipment	Westinghouse straight air
Fuel tank capacity	400 gal

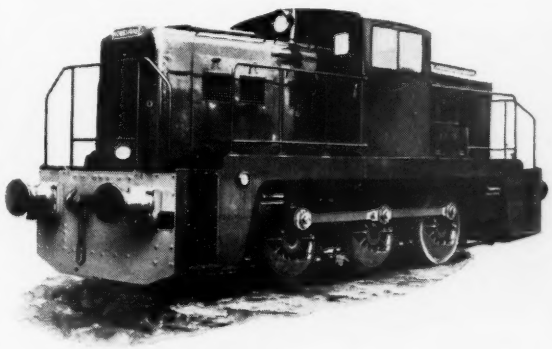
The "Janus" follows conventional rigid frame design composed mainly of steel sections and, as most of the weight is in the under-frame, its strength is superior to a steam shunter and to most other types of diesel locomotives. The engine generator sets are mounted on resilient supports and there is no direct connection, other than electrical, between them and the traction motors which hang on the outside pairs of wheels. The driving cab is centrally placed with doors opening on to diagonally opposite platforms accessible from the front and rear buffer platforms. The control desk is placed in the centre of the cab to allow the driver maximum freedom of movement without loss of visibility. Control is by means of a throttle which is directly connected to the two engine governors and also operates the main contactors. There is also a reverser which is mechanically interlocked with the throttle, and a brake handle. All controls are duplicated at each end of the central desk. It is impossible to overload the diesel engines because the generator characteristics adjust the speed of the locomotive to suit the tractive effort required. This system of control provides smooth and continuous variation of locomotive speed and tractive effort between standstill and full h.p. When limited power is required for light duties one engine generator can be shut down.

The wheels of the locomotive are coupled together and overhung springing is provided in the axle boxes, which can be equipped with either plain or roller bearings. A 24-cell battery is used in series for starting the engine and in parallel for lighting and for the cab heater ventilating fan.

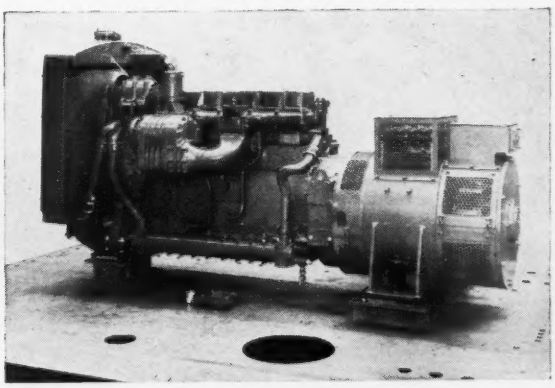
The self-ventilated traction generator is directly coupled



The B.T.H. traction motor is spigot mounted on an axle-hung gearbox



The "Janus" 400 h.p. diesel-electric shunting locomotive



200 h.p. Rolls Royce/B.T.H. engine-generator set

to the diesel engine and has a continuous rating of 124 kW at 500 V when running at 1,800 r.p.m. The machine is a single bearing six-pole generator and it weighs about 2,200 lb. The traction motor is also self ventilated and the continuous rating on full field is 143 s.h.p. at 1,330 r.p.m. It is a four-pole machine and it is spigot mounted on an axle hung gearbox.

Impulse Strength of Dielectrics

THE discussion on the three papers dealing with the impulse strength of dielectrics, read at a joint meeting on 25th April of the Supply and Measurement and Control Sections of the Institution of Electrical Engineers, reported in our last issue, was opened by Mr. R. Davis (N.P.L.), who suggested that in papers of the kind presented by Mr. Hall and his colleagues, where much experimental data had been accumulated, it would be valuable to present this data in such a form that other people had a chance of interpreting it for themselves. He thought a new uncertainty principle applicable to engineering had been discovered, the authors having shown, for example, that variables such as apparent thickness, impermeability and possibly density were a function of measuring equipment. This was approaching the realm of physics.

Mr. L. C. Richards (Metropolitan-Vickers) expressed the hope that the work on solid and liquid dielectrics would continue. The subject was tremendous and there were many variables. He asked whether the authors had studied power factor readings and tried to relate them to the condition of insulation in respect of breakdown and the strength of impulses.

Mr. C. C. Barnes (C.E.A.) described the methods employed to develop power cable systems for the highest voltages designed to obviate ionisation under all conditions of load, or even overload, experienced in service. He suggested that the new synthetic materials now available and the ever-expanding knowledge of chemical structure would lead to smaller, lighter and more efficient supervoltage cables.

Dr. B. Salvage (Henley's) said that investigations into the impulse strength of lapped impregnated paper dielectric using cable models had led to somewhat different conclusions from those given by the authors. An increase in the paper density was thought to result in a decrease in the impulse strength of the composite dielectric, but the effect of the impermeability was related to the viscosity of the impregnant.

Mr. H. F. Church (E.R.A.) said that moisture was very important in connection with long-term failure. Another omission was conducting occlusions; large carbon particles could lead to extremely high local stresses.

Mr. D. H. Booth (Glover's) emphasised the saving in cost which was made by the cable model testing technique, while pointing out that its validity depended on such testing being tied up with full-size cable testing. It was of great importance that cable makers were now taking the lead in deciding what to put in their cable and not merely accepting what the suppliers of paper and oil gave them. In particular, their concentration on breakdown was to be commended.

Mr. G. Palandri (Pirelli, Milan) expressed satisfaction that both Mr. Hall and his associates and the laboratories of his own company had independently reached the conclusion that the variation of impulse strength with temperature was related to the viscosity/temperature characteristic of the impregnant.

Mr. A. E. Brierley (English Electric) observed that the paper on solid and liquid dielectrics contained useful information on transformer design. The new strength found in applying alternate polarities added further support, he said, to the necessity for including chopped waves during impulse tests on transformers.

Mr. F. C. Walmsley (Micanite & Insulators) confirmed Mr. Richards' plea for more work on solid and liquid dielectrics. The authors' implication that thickness of tubes had no appreciable effect on pressure was contrary to earlier opinion, but there was some measure of support for it and he hoped the point would be elaborated further.

Mr. F. Miranda (Pirelli-General) said that while cable designers had been supplied with much needed information the limitation of cable models must be stressed. Flexibility, for instance, was a major consideration in the design and manufacture of cable, but the authors had shown it to be a factor of no importance in cable models.

Mr. P. R. Howard (N.P.L.) said it would appear from the figures that the effect of an increase in the number of butt gaps over-rode any advantage from using very good paper. The breakdown process was complex and probably had a great deal to do not only with the strength of the liquid but also with the complex capacitance effect set up in a combination of dielectrics.

Dr. H. House (Queen Mary College) pointed out that a simple method, if somewhat inaccurate, of estimating the inception of discharges was to take not a cylindrical electrode system but the equivalent two-dimensional system by means of which the tangential stress could be calculated.

Mr. G. W. Bowdler (N.P.L.) commented that while the paper by Hall and his colleagues showed clearly how the paper must be arranged to give the best results, it was to the liquid medium that one must look for further improvements in the electric strength. This was one good reason why the work on liquid dielectrics should continue.

Mr. J. H. Mason (E.R.A.) suggested that there was evidence that the propagation of breakdown generation from solid dielectrics depended on stress concentration at the end of a discharge and on the energy associated with the discharge.

The authors briefly replied.

A.P.L.E. Conference

THE annual conference of the Association of Public Lighting Engineers will be held at Blackpool from 18th to 21st September. The headquarters will be at the Empress Ballroom, Winter Gardens, the exhibition of street lighting apparatus and equipment will be in the Indian Lounge and Empress Ballroom annexe, and the outdoor displays of lamp columns and mobile equipment on the Middle Walk Promenade.

The first day's proceedings will include an official welcome and opening of the conference by the Mayor of Blackpool, the induction of Mr. H. Carpenter (illuminations and public street lighting officer, Blackpool) as president, his presidential address, the opening of the exhibition and a reception by the Mayor and Mayoress.

During the conference the following papers will be read:—"Light Source—New Developments and Trends," by H. W. Cumming; "Luminaires—Design and Development," by J. G. Holmes and W. T. Souter; "A Review of Public Lighting (Great Britain)," by C. C. Smith; and "The Continental (Europe) Trend of Public Lighting," by Prof. N. A. Halbertsma.

Capital for Nationalised Industries

The Start of a New Regime

By D. J. BOLTON
M.Sc., M.I.E.E.

In his Budget speech on 17th April Mr. Macmillan, the Chancellor of the Exchequer, announced that as a temporary measure he proposed to meet the capital requirements of the nationalised industries out of the Exchequer. He mentioned a maximum sum of £700 million over a period of two years. In this article Mr. Bolton examines some of the implications of the Chancellor's statement.

NO time has been lost in putting into effect the new method of financing the nationalised industries. Three days after the Chancellor had announced in his Budget speech that in future the Exchequer would take over the sole responsibility came the news of the first issue under the new arrangement. This issue of £250 million, although in effect merely one more addition to the existing nationalisation stock, has this time been issued by the Treasury instead of by the industries themselves. What is perhaps more surprising is that the Budget announcement (and the first instalment of centralised borrowing which immediately followed it) came only three months after the presentation of the Herbert Report in which exactly the opposite development was recommended for the electricity industry.

Former Practice

The financing arrangement which was set up for most of the nationalised industries (other than coal) in the period 1947-48 and came to an abrupt halt a week ago was something of a compromise, aimed at combining the low rates of interest associated with Government enterprises with the freedom of action appropriate to an autonomous corporation. The central authority (e.g. the British Electricity Authority or the Gas Council) floated its own loans as and when the need arose but both the interest and the repayment were guaranteed by the Government. Each corporation had a statutory limit to its total borrowing and doubtless there was some measure of Treasury consultation and control regarding times and methods, but the corporation still retained the dignity of a financial entity, borrowing and spending its own capital and servicing the debt from its revenues like any commercial concern.

From this middle-of-the-road position the Herbert Committee recommended a move in the direction of greater independence: what has happened is a move in the opposite direction. The Committee would like to see each board (and not merely the central authority) go to the money market for its capital requirements, pledging its own credit and without any Treasury underwriting. The Chancellor's approach was much more tentative. Whilst approving the principle he suggested only that the time "may" come when this could happen, and perhaps electricity and gas "might" be the pioneers. At present, he said, neither these industries nor coal or railways had a "cat in hell's chance" of doing so.

Just what this chance is one cannot say without more knowledge of the nether regions than one hopes ever to have, but one would expect a cat to have nine times as good a chance as any other animal. Allowing, however, for the vigour of the simile, are the chances of the electricity industry in the money market really so poor? A monopolist supplier of an essential service with a steadily rising demand is surely in a strong financial position through the very nature of its business. Even without Treasury support there is the statutory requirement so to operate as to cover all properly chargeable outgoings, and since these must include debt servicing this is almost the equivalent of a Government guarantee of interest and repayment.

Nor does pre-vesting history point to any serious difficulties. The companies, in spite of their limited franchises, raised all the money they needed in the open market. The local authorities, it is true, could pledge the security of their rates in borrowing money for electricity development, but how often in fact did they have to fall back on this underwriting? Nine times out of ten it was the rates which benefited from electricity profits rather than the reverse.

The Chancellor also seemed to think that there could have been more "ploughing back" of profits by the nationalised industries, and pointed out that of the total capital expenditure on coal, gas, electricity, transport and airways since the nationalisation of these industries only about 40 per cent had come from internal resources. It is difficult to deal with a generalisation covering five so widely varying industries, but in the case of electricity one may well feel that such a proportion is a creditably high one.

One can only criticise the figure by considering what it is a percentage of, and with electricity supply it is per cent of a very high quantity indeed. Electricity supply is one of the most heavily capitalised industries in the country, in the sense that a very large head of assets is needed in order to earn a relatively small revenue. Added to this it is one of the fastest growing, so that on both counts it would be unreasonable to expect more than a very small proportion of these huge assets to be built up out of revenue.

Industrial Comparison

By way of contrast in this matter of degree of capitalisation one may look at a typical conglomeration of "light" industries such as that represented by Unilever, Ltd. This has some three-and-a-half times the turnover of the British electricity system with only one-seventh of the fixed assets, or (including current assets) about one-third as great a total of capital requirements. The same thing can be expressed in another way by supposing each of these two industrial complexes to set aside each year 10 per cent of its gross revenue towards meeting future financial requirements. In electricity supply it would take 31 years (without accrued interest) for the sum set aside to equal the present value of the assets employed in the business, whereas in the light industry it would take only 2½ years.

One can form some idea of the intensity of capitalisation of a business by seeing how much capital must be employed in order to produce a given revenue. The amount of this investment may be measured roughly by the written-down value of the fixed assets (first cost less depreciation) plus the net current assets (stocks, stores, etc., plus financial assets less current liabilities). The ratio of this total to

the turnover measures the degree of capitalisation. On this basis electricity supply is more than twice as highly capitalised as its nearest neighbour, gas supply, and nearly twelve times as highly capitalised as the light industry mentioned. The following compares the investment required to produce a gross revenue of £100 per annum:—

Capital Required to give £100 Turnover

	£
British electricity industry	311
British gas industry	143
General light industry	26·5

A surprising feature of the new financing arrangement is that it covers only the next two years, which is a very short period in the life of a capital-raising programme. Possibly it is the first step towards a new relationship between the Government and these industries. Alternatively, it may be only an interim device to meet special and, it is hoped, only temporary difficulties in the money market.

The new arrangement has obvious advantages from the point of view of Treasury convenience but inevitably it means less independence for the industries concerned. Whilst it makes no difference to the procedure whereby Government approval is given to the boards' investment programmes, and whilst (on paper at least) it adds no further degree of financial control, still (as the Chancellor shrewdly remarked) "If one actually presses the fee oneself into the piper's hand, one has a better chance of influencing the tune."

With greater Government control (*de facto* if not *de jure*) must come some lessening of individual responsibility on the part of the industries. The Herbert Committee laid great stress on the importance of commercial accountability for the electricity boards and suggested that if each board had to attract its own capital so that every quota of investment must yield an adequate return, this would do much to keep the board "on its toes." By contrast, when the nationalised body borrows, like the Coal Board, from a Government department this commercial imperative becomes weakened. Assets and their earning capacity are lost sight of under the umbrella of a single large overdraft, and there is nothing to prevent the economy from slipping a little further back every year. It must be for the electricity industry to see that a loss of financial autonomy leads to no slackening in the search for efficiency, and to hope that its development will not be checked through being geared to industries of a different tempo and capital requirements.

"Investing in Coal"

NATIONAL COAL BOARD'S PROGRAMME

A PUBLICATION under the above title has been produced by the National Coal Board. In effect it is a revised version of "Plan for Coal" which was published five years ago, and in introducing the revised plan Mr. James Bowman, C.B.E., chairman of the National Coal Board, said he thought it was a more reliable and realistic document than "Plan for Coal."

"Investing in Coal" points out that in the earlier days of nationalisation the task of reconstruction was placed upon an industry which was just emerging from a long period of decline, and at a time when current output was being out-stripped by current demand. The material and intellectual resources had first to be assembled and this required action in many fields at once—in recruitment, staffing, training, education, welfare, research and engineering. The plan showed the need to raise investment in coal-mining as rapidly as the technical resources available would allow. Experience during the past five years has shown that both the difficulties and the cost of creating a healthy coal industry were much greater than was thought at the time.

The annual output of deep-mined coal which would be required in 1961-65 was taken as about 240 million tons, against an output of 203 million tons in 1949. (In addition, opencast mining produced about 12 million tons.) In order to achieve this large increase in output it was proposed that more than 250 collieries should be reconstructed, that some 20 new large collieries and 50 new surface mines should be opened, that about 250 collieries should remain basically unchanged apart from minor improvements and mechanisation, while the remainder would either be closed or absorbed in the reconstruction schemes.

The N.C.B. took over about 20 major schemes on Vesting Day; to these were added about as many new schemes in the three years from 1947 to 1949. Major schemes are new sinkings, new surface mines, or colliery reconstructions, costing more than £250,000.

"Plan for Coal" envisaged the probable opening of 18 new collieries and the re-opening of a further four. At the end of 1955 fourteen new collieries had been completed or were in progress, plus twelve drift mines and four re-openings. Major reconstructions mentioned in "Plan for Coal" numbered 259 and of these 137 had been completed or were in progress at the end of last year (excluding twelve separate coal-preparation schemes).

The number of completed projects is still small in relation to the volume of work in progress. Consequently the tangible results of the reconstruction effort to date are also small. The main characteristic of this work is the length of time required to complete a big colliery scheme because lack of space underground severely limits the number of men and machines that can be employed; this is particularly true of such essential preliminaries as sinking new shafts and driving new tunnels. The Board's most recent survey shows that with present techniques it takes on an average more than ten years to complete a new sinking and over eight to carry out a big reconstruction scheme.

The £323 million of capital spent on schemes at collieries falls into two main sections: £128 million spent on 179 major schemes each scheduled to cost more than £250,000 on completion; and £195 million of "other capital expenditure," which was on a large number of minor schemes and routine plant replacements throughout the industry. Of the £128 million spent, all but £11·5 million is still in the "pipeline."

The output performance of the 20 collieries with completed major schemes is as follows: 1947, 6·3 million tons; 1951, 8 million tons; and 1955, 9·1 million tons. The expansion of output between 1947 and 1951 is only partially attributable to the schemes because during these

years recovery from wartime conditions resulted in a general expansion throughout the industry. But the expansion between 1951 and 1955, when the output of the industry as a whole was little changed, is a clear indication of the results of reconstruction.

The £195 million of "other capital expenditure" has been spent on a very large number of projects, ranging from small routine plant and other replacements to large "minor" schemes whose cost nearly puts them into the "major" group at £250,000.

The Board believes that this country needs all the coal that can be produced within reasonable economic limits. On the assumptions of rapid and continuous economic growth and continued progress in fuel efficiency, inland demand for all forms of primary fuel in 1965 may, as the Minister of Fuel and Power recently said in the House of Commons, exceed 300 million tons of coal equivalent, compared with the 1955 consumption of 250 million tons. The use of oil can be expected to continue to grow rapidly, and from 1960 onwards nuclear power stations will begin to provide a new source of energy, but even in the longer term the problems of over-production for the coal industry can scarcely arise.

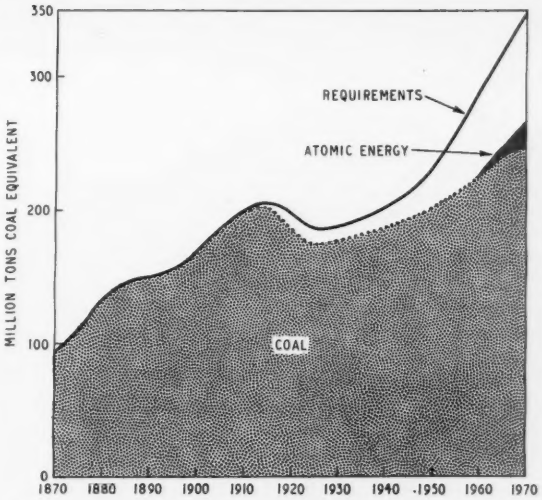
In 1950 it was thought that an output of 240 million tons a year in 1961-65 would leave some 25-35 million tons a year for export and bunkers. Since then, inland demand has risen rapidly and all indications point to a further rise. The revised plan provides for an output of coal from all sources—including opencast—of 228 million tons in 1960 and 240 million tons in 1965. The Board has come to the conclusion that an output of 250 million tons a year cannot be attained before 1970 instead of in 1965 as it had hoped.

To achieve the outputs for 1960 and 1965 it will be necessary by the end of the latter year not only to complete the vast majority of the major reconstruction schemes now in progress, but also to start and complete more than another hundred. In addition it will be necessary to continue with routine plant replacements, mechanisation and minor schemes. Because reconstruction in the coal industry is not a once and for all effort, but a perennial requirement, the Board will also have to invest money in major schemes which will not come to fruition until after 1965.

The Board estimates that the capital cost of achieving these output figures and of providing the money for major schemes to be completed after 1965 will be £860 million for collieries and their associated activities. In addition it proposes to spend £140 million on ancillaries. A total of £590 million will be spent in the next five years and £410 million in 1961-65.

It is primarily shaft-sinking and tunnelling that determine the speed at which mines can be reconstructed or new mines created and various means of increasing this speed are in hand.

Coal transport underground has been highly mechanised for many years. The same applies to cutting the coal in the seam, but the mechanisation of most of the other coal-face operations is difficult if only because of the great variety of seam conditions. The proportion of coal cut by machine increased from 75 per cent in 1947 to about 86 per cent in 1955 and can hardly be raised much higher. But both shot-firing and loading in present-day normal mining practice remain manual operations. Mechanisation by a combined cutting and loading process has, therefore, been a main development objective. This is generally called "power loading." Only about five million tons of coal were power loaded in 1947 and the only types of machines available were of limited application. The last eight years have seen the development of many new machines and about a dozen different types are now available, while a number of others are in various stages of development. The Board is, therefore, now in a position to apply power loading on a much wider scale than ever before. The saleable output obtained by machines of these kinds increased from 7½ million tons in 1950 to 23 million tons in 1955, and it is hoped to double this figure within the next three years.



Great Britain's fuel and energy requirements and the contribution of coal 1870—1970

This graph is not a precise statistical statement but a general representation of Britain's energy economy over a hundred years. The fuel and energy requirements include coal and the coal equivalents of coke, oil, atomic energy and hydro-electricity for inland consumption, and foreign bunkers. Future requirements shown conform generally with recent forecasts.

Institute of Fuel

AT the annual luncheon of the Institute of Fuel on 25th April the toast of "The Guests" was proposed by the president, Mr. R. H. Gummer, who referred to the presence of a number of distinguished visitors and of seven past-presidents. Among the latter were Lord McGowan and also Sir William Larke, to whom he conveyed congratulations on his 81st birthday. He then presented the Melchett Medal (its 26th award) to Sir Alfred Egerton, who is to deliver the Melchett Lecture next autumn. After paying a tribute to Mr. R. W. Reynolds-Davies, the secretary, and his staff, he referred to the relinquishing of his appointment as editor of the Institute's journal by Mr. W. T. Cooper, who is going to Australia to become branch secretary there.

Response was made by Mr. R. P. Morison (independent chairman, British Iron and Steel Federation) who stressed the importance of fuel economy at all stages of the steel industry, which was using yearly 30 million tons of coal or its equivalent, one-eighth of the amount used for all purposes in Great Britain. About 26 million tons were taken as coal, 2 million as oil and 2¼ million as electricity, in aggregate value representing one-fifth of the total costs of the industry. The need to keep scarce high-grade coking coal for blast furnaces and the savings resulting from preparation were discussed. A coke consumption of 27 cwt/ton of steel could be reduced to 22 cwt by partial preparation and to 18 cwt by full preparation. Less than half the coking coal produced was now used in carbonisation processes. In industry generally, equipment installed for fuel saving, in which were included automatic control of combustion and instrumentation, should, he considered, be exempt from tax.

Temperature Rises in Electrical Machines

Motor Design Problems Discussed

THREE papers on the heating of electric motors with variable loads and speeds were presented before the Utilisation Section of the Institution of Electrical Engineers on 19th April. Professor A. Tustin (London University), joint author in all cases, was associated with Dr. J. J. Bates (Military College of Science) in two papers and with Messrs. D. F. Nettell (Powers Samas Accounting Machines) and R. Solt (Brush Electrical Engineering Co.) in the other. The tests were carried out with a 25 h.p. mill-type d.c. motor lent by the General Electric Co., together with the services of Mr. J. Armstrong.

The first paper related temperature rises and losses to the properties of thermal networks of lumped conductances and capacitances. These relationships in a machine running at a given speed were shown to differ materially from those for thermal networks but to be linear at that speed. On-off tests to obtain distinctive distribution of losses at various speeds indicated that the coefficients (conductances) were not linearly related to speed, thus impairing the cooling of the motor at all but low speeds; this departure from linearity was attributed to the arrangement of the fan of the motor used. It appeared necessary to make observations at several speeds and to modify the procedure if the non-linearity was marked. The principles of the intermittent tests described were regarded as applicable to other electrical apparatus, such as a.c. motors and transformers.

The second paper described how the mean temperature rise of a specified part, e.g. the armature winding, on a short-run service with variable load and speed could be related to the results of on-off tests on the test bed. Means were indicated of avoiding possible errors, which were small when thermal conductances for heat dissipation varied linearly with speed.

The final paper dealt with the preparation of curves to facilitate design or selection of motors for services with short runs such as cranes or urban transport. From these curves mean speed, power consumption and temperature rise on a specified schedule could be estimated for various combinations of windings, gear ratios and accelerating currents for series-wound motors having magnetisation curves of the shape characteristic of modern mill-type machines.

DISCUSSION

Mr. C. C. Inglis (British Railways) questioned whether the same analytical approach had been made to heat problems in electrical machinery as had been made on the electrical side. Was a similar flux plotting technique used for the establishment of a temperature gradient or a hot spot or any thermal phenomenon within the body of the machine? Some years ago when asked to check power factor, a number of firms found their machines were working on half or quarter load. Rearrangement was considerably to their financial advantage. The same might apply to the temperature of motors, and he would suggest that a reasonably regular check ought to be taken. It was the temperature of the motor that decided its life, and this was of first-class importance in economics.

Mr. A. Asbury (English Electric Co.) said that in their third paper the authors had produced a systematic answer to a very complex problem. Even if computers were used on this work, the clearing up of many misconceptions as to short-run duties would be particularly helpful. A point of interest was that in steel mill-type motors particularly the size of the motor was determined by completely different characteristics such as, for instance, the need to be able to screw down in a hot reversing mill, even if there was a piece between the rollers.

Mr. J. A. Broughall (British Railways) said that the paper was important because they were about to embark in British Railways on a system of electrification using alternative current tracks. They were about to develop machines not produced in this country before and it was essential that they should be efficient, light, inexpensive and safe. The new methods might make possible the use of higher temperatures and new insulating materials, but before they could be used with safety it was essential to know all there was to know about them.

Dr. E. Hughes said that the work of testing machines for temperature rise was extremely tedious. He was not too happy about the results given in the papers being taken as a criterion without being checked as they would be in normal routine testing, and commented on the absence of any reference to the measurement of temperature rise by thermometer. He agreed, however, that academic tests must be made if consistent results were to be obtained. He asked how the temperature rise was to be reckoned in the actual machine, since distortion of the flux, with a loaded armature, might increase the loss considerably.

Mr. W. Hill pointed out that neither the manufacturer nor the customer had the time to work out the lengthy calculations required to produce a short-time rated motor, and the usual British standard of full-time rating was therefore resorted to. Would it not be sensible to make a distinction, as in Swiss standards, between, say, duty cycle and intermittently rated machines?

Designing with Computers

Mr. P. Wegner said that design procedure was often based on *ad hoc* methods not always justified logically. They were empirical procedures to shorten the calculations and were often said to be based on intuition. The computer, on the other hand, required a fundamentally different approach. The step-by-step design procedure must be rigidly fixed and every step must be logically defined. The authors' work might eventually lead to a procedure for designing the most efficient machine by feeding a specification into an electronic computer and obtaining the required design parameters as output.

Mr. G. H. Davidson asked what was the alternative to the one-hour rating. Before it was scrapped, he said, there must be an alternative easily understood by everyone. While efficiency was important, users of machines were more interested in overall or commercial efficiency, and one breakdown in a modern production mill might cost more than the price of several new motors.

Mr. J. M. Ferguson said that while design was to-day along better and more serviceable lines, this sometimes meant reducing the margins allowed in the past for the ignorance factor.

Mr. C. F. R. Fielden said users often tended to insist on machines known to be too big for their purpose, which was a waste of energy during acceleration periods. If the authors' work could be followed up by work in the field, as he understood was the case, to assess the duties of the different machines, they would indeed be getting somewhere.

Mr. J. H. Messenger commented that the maximum torque condition was fixed by physical size and the only real solution was to increase the temperature rise by reducing the amount of copper. This would lead to a different conception for—should he say?—the standard works test.

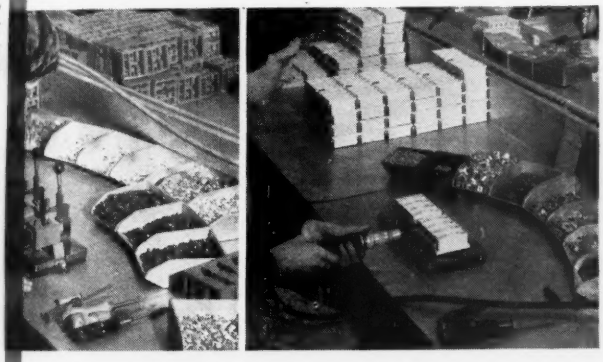
Dr. L. N. Bramley (British Iron and Steel Research Association) said that the Association intended to make and publish the results of tests on the standard range of motors and mill-type motors for the benefit of the steel industry and other industries using mill-type motors.

Stepping Up Fusegear Production

NEW WORKS OF BILL SWITCHGEAR, LTD., IN BIRMINGHAM

A NEW factory, known as the Crown Works, has recently been opened by Bill Switchgear, Ltd., at Kings Standing, Birmingham, not far from the company's main works and head office at Perry Barr. The new works, covering 33,000 sq ft, is on a new two-acre site, allowing ample room for expansion, and is devoted to the production of all types of distribution fusegear, both domestic and industrial.

The company was founded in 1906 by Mr. R. W. Bill and Mr. S. Bill and the former of the two partners, now the chairman of the company, is still in regular attendance at the factory. Manufacture is carried out at three factories in the Birmingham area: that at Aston Lane, Perry Barr, now concentrates on industrial switchgear; that at Victoria Road makes electrical accessories and domestic switchgear; and the Crown Works makes distribution gear. Now that the new works is in operation a concentration of production of the various classes of products into the separate factories has been achieved, with a consequent improvement in output of all types of apparatus. It is hoped that this will help to relieve the continuing pressure of demand for the gear and will enable quicker deliveries to be offered.



Air-ejection assembly jigs in use on a porcelain switch base and an 8-way fuse bank. The operator moves a lever below the bench and the assembly is automatically and evenly pushed clear of the jig

General view of a final assembly line

The Crown Works is a single-floor building of modern design at present employing about 260 people, after only two months of occupation, and capable of employing about 400 when fully utilised. Being conveniently situated between two large Corporation housing estates, labour has not proved a problem.

The factory is divided broadly into a sheet metal section where galvanised steel is cut and pressed to shape and assembled into distribution board casings; a stoving and spraying plant where all cases (except the largest, which are sprayed) can be dipped and dried in a gas-fired conveyor oven; a sub-assembly area; and a final assembly area where fuse assemblies, etc., are mounted into the casings.

An interesting technique with air-operated jigs is employed in the sub-assembly area. These are used in the assembly of items on the porcelain bases of a grade of small switchgear known as the "Crown" range, and in the production of complete fuse banks. Certain of the metal items are located in the jig base and the porcelains and other items assembled on top. Accurate assembly is thus assured, but in the past a considerable number of breakages has tended to occur when the assembly is removed from the jig. In the system now employed air pressure is applied in the correct proportion to a number of ejection points which results in a very even removal of the sub-assembly from the jig. The number of breakages has thus been substantially reduced and greater accuracy of initial assembly and increased output have resulted. Air is also largely employed for portable screwdrivers and other assembly tools. The air jigs used for fuse bank assembly have a multiple application and that illustrated can be used for the manufacture of two, four, six or eight way banks.

Equipment made in the new factory consists of distribution boards from 10 A to 300 A rating and in standard assemblies up to 12 ways three-phase; "Crown" switchgear in 15-60 A sizes; and cable glands capable of accommodating sizes up to 0·6 four-core p.i.l.c. cable. Following on the occupation of the works a range of angled cable glands is now being produced.

I.E.S. Summer Meeting

THE biennial summer meeting of the Illuminating Engineering Society will be held at Harrogate (headquarters, Majestic Hotel) from 8th to 11th May. The papers to be read during the meeting are as follows:—"Light and Colour in Daily Life," by J. W. Strange and H. Hewitt; "Lighting of Small Factories," by J. S. McCulloch; "A Critical Analysis of Lighting Equipment and its Maintenance," by J. Mortimer Hawkins and C. J. Veness; "Lighting Developments in Germany," by Prof. Dipl.-Ing. L. Schneider; "Lighting Developments in Czechoslovakia," by Ing. J. Havelka; "The Apparent Brightness of Coloured Light Sources," by W. R. Stevens and H. M. Ferguson; and "Decorative Lighting," by D. W. Durrant.

In addition to the above, a number of visits and social events have been arranged, including a pre-meeting tour for overseas visitors from Sunday (6th May) to Tuesday.

INDUSTRIAL NEWS

Engineering Workers' Claims

Resolutions calling for a substantial rise in wages, a 40-hour week without loss of wages, and three weeks' holiday with pay were carried at last week's annual conference of the Amalgamated Engineering Union. Although no amount of increase was specifically stated it is believed that at least 20s a week is envisaged.

Automation was discussed at the conference and resolutions were passed insisting that displaced workers should be retained until other work could be found for them, that increases in productivity should be reflected in higher wages, that all engineering workers should have technical training in automation, that automation plans should first be discussed with shop stewards and that a committee representing the Government, the employers and the trade unions should be set up to control the introduction and scope of automation.

Design Centre Opening

Claimed as being the world's first permanent selective exhibition of such a wide range of goods, the Design Centre was opened on 26th April at 28, Haymarket, London, S.W.1, by the Duke of Edinburgh. Organised by the Council of Industrial Design, the Centre will be a permanent but constantly changing exhibition of well-designed British goods, and all goods displayed will be selected from the "Design Review," the Council's photographic and sample record of goods chosen by a specially appointed committee under the chairmanship of Sir Gordon Russell. The annual cost of running the Centre is estimated to be £80,000 and provided that a minimum of half of this sum is covered by receipts from the exhibitors' fees, the Government has agreed to match the Centre's receipts, subject to a maximum not yet determined. In addition over £25,000 has already been contributed by firms.

The Duke said that the Centre would help the manufacturer and designer to follow current technical developments in the finished article and have the satisfaction of knowing that their products were seen by discerning buyers from all over the world; and secondly it would help buyers and consumers to see the best that was available. The best thing that could happen to British manufacturers would be a highly critical and selective home market, constantly demanding better designed, better made and more reliable goods, and by using a more critical eye it would help our manufacturers to compete abroad.

Nearly 70 well-known electrical manufacturers are represented amongst the exhibitors, and their products include a wide range of domestic appliances (fires, cookers, refrigerators, water heaters, vacuum cleaners, kettles, washing machines, food mixers, lighting fittings, etc.), radio and television sets, office equipment, electric clocks, and models of street lighting fittings. At the same time electricity showrooms and retailers throughout the country are arranging special displays of items from the exhibition. The exhibition will be open for six days a week from 9.30 a.m. to 5.30 p.m.; admission and information services are free.

The new Design Centre in Haymarket, London

National Industrial Safety Conference

Once again the National Industrial Safety Conference and trade exhibition of industrial safety appliances, organised annually by the Royal Society for the Prevention of Accidents, is to be held at Scarborough, under the chairmanship of Mr. R. E. Tugman, division safety officer, alkali division, Imperial Chemical Industries, Ltd. This year the function will be attended by nearly 600 delegates from all branches of industry, while about 50 manufacturers and organisations will be represented in the trade exhibition. All meetings will be held in the Theatre, where delegates will be welcomed on the evening of 11th May by the Mayor of Scarborough. Following the civic reception the presidential address will be given by Sir Howard Roberts. The opening address to the conference will then be given by Mr. I. Macleod, M.P., Minister of Labour and National Service.

Four papers will be read on Saturday, 12th May. In the morning Mr. R. J. Sherwood, health physics division, Atomic Energy Research Establishment, Harwell, will discuss "Safety Precautions in the Use of Radio-isotopes"; he will be followed by Mr. R. G. Bellamy, education and training officer, Central Electricity Authority, whose subject will be "Education and Training of Entrants to Industry." In the afternoon a paper on "Dust Suppression in Industry" will be given by Mr. W. B. Lawrie, engineering and chemical branch, Factory Department, Ministry of Labour and National Service, and a paper on "Skin Irritants" will be read by Dr. C. N. D. Cruickshank.

On Sunday morning the final paper, "The Use of Electronics for Safety Devices," will be read by Mr. B. G. Higgins, of the British Thomson-Houston Co., Ltd. The Trade Exhibition will be in the Corner Café, adjoining the conference hall.

Trade with Russia

A joint statement upon last week's Anglo-Russian talks was issued on 26th April. One passage dealt with the possibilities of trade between Great Britain and Soviet Russia. The Russian representatives stated that if there were no restrictions purchases could be made in the United Kingdom to the value of £800-£1,000 million in the next five years. It was pointed out that part of the list of goods mentioned by the Russians was covered by strategic controls but in spite of that there was substantial scope for increased trade.

Later a list was issued by the Russian Embassy of the goods which Russia would like to purchase in the United Kingdom. This included "power trains with gas turbines of 5,000 kW," stationary gas turbines of 20 to 30 MW and high frequency furnaces as well as a variety of machinery.

A.S.E.E. Exhibitors' Meeting

A meeting of exhibitors at the Electrical Engineers (A.S.E.E.) Exhibition will be held at the Caxton Hall, Caxton Street, Victoria Street, London, S.W.1, at 2.30 p.m. on 12th June next to discuss the report on the 1956 exhibition and the planning of the 1957 exhibition which is to be held at Earls Court from 9th to 13th April.

Salaried Status for P.O. Technical Officers

Under an agreement between the Post Office and the Post Office Engineering Union, 15,000 technical officers will be given salaried status with effect from 1st April. This follows a decision of the Civil Service Arbitration Tribunal that the grade should be paid by annual salary instead of by weekly wage. The new annual rates for technical officers now

range from £490 to £665 in London, and from £475 to £640 in the Provinces.

The Union has also made an agreement with the Post Office for increases to cable ship crews, ranging from 11s to 14s a week.

Turbo-Alternators for Canada

The Saskatchewan Power Corporation, Canada, have placed an order with C. A. Parsons & Co., Ltd., Newcastle-upon-Tyne, for two 66 MW turbo-generators with condensing plant and feed water heaters to be installed in the new Boundry Dam power station, Saskatchewan. The contract provides for the supply, delivery and complete erection of the two machines and amounts to a total value of about £1,200,000. The first machine has to be in commission by October, 1958, and the second machine twelve months later.

Lamp Price Reductions

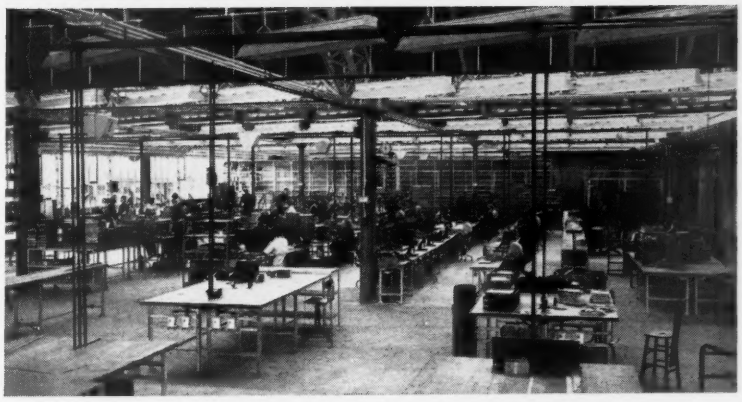
The following companies have announced reductions in the prices of their candle lamps and sodium discharge lamps:—Philips Electrical, Ltd.; Thorn Electrical Industries, Ltd.; Ekco-Ensign, Ltd.; Siemens Electric Lamps & Supplies, Ltd.; Stella Lamp Co., Ltd.; A.E.I. Lamp & Lighting Co., Ltd.; and the General Electric Co., Ltd.

Rectifier Factory Lighting

To allow for future extensions the new factory of Standard Telephones and Cables, Ltd., at Templefields, Harlow, Essex, consists of three separate production blocks, each constructed by a different method. This has necessitated the use of three systems of interior lighting, and the fittings, supplied by the General Electric Co., Ltd., are designed to meet the requirements demanded by the various production processes taking place there. The factory, which is for the manufacture of rectifier equipment, was designed by the Harlow Development Corporation in conjunction with Standard Telephones and Cables, Ltd., and has a floor area of 176,735 sq ft.

To provide the required value of illumination of 30 lumens per sq ft in the building which houses the first production area lighting is supplied by specially designed ceiling fittings, with no dust collecting ledges. Each fitting houses two "Osram" 80 W fluorescent tubes, and has a diffuser of opal "Perspex." The fittings are installed in continuous lines along the roof.

The value of illumination specified for the second production area was 30/40 lumens per sq ft. This is supplied by vitreous enamelled trough reflectors each of which houses two 80 W fluorescent tubes. Similar reflectors, arranged on continuous lighting trunking, illuminate the third area. The heavy equipment assembly bay has a high roof and mixed lighting units are installed. Each of these units accommodates its own control gear, houses one 400 W high pressure mercury lamp and one 1,000 W tungsten lamp, and has anodised aluminium reflectors.

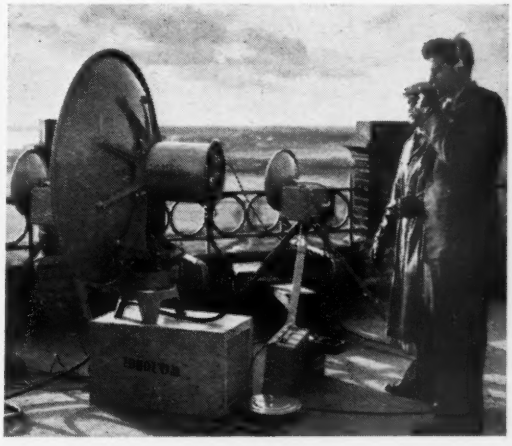


G.E.C. vitreous enamelled trough reflectors installed in the second production area of the new factory of Standard Telephones & Cables, Ltd., Harlow, Essex

The imposing entrance hall of the administrative block has tungsten lighting fittings recessed into the ceiling. In the works canteen illumination for normal use is provided by 500 W tungsten lamps in pendant fittings. Extra lighting can be obtained from fluorescent tubes behind plastic louvres. All the laboratories and administrative offices are illuminated by ceiling fittings with reeded "Perspex" diffusers, and two 5ft 80 W tubes. Fittings of similar pattern housing single tubes are used for corridor lighting. The G.E.C. has also supplied floodlights and streetlights for this new factory.

T.V. Equipment for Russia

The accompanying picture shows Marconi centimetric link equipment undergoing field trials before being shipped to Russia. This apparatus represents part of a large quantity of television equipment which Marconi's are supplying to the U.S.S.R. Amongst the main items in this order are included two 3-camera television outside broadcast vehicles, two mobile petrol-electric trailer power units and a comprehensive supply of spares. Marconi Mk. III cameras fitted with 4½in English Electric "Image Orthicon" pick-up tubes are incorporated in the outside broadcast vehicles. To link these vehicles with a broadcasting centre, two sets of centimetric vision and sound links (one for main, one for standby) are being supplied for each, together with a v.h.f. communication link for programme control purposes. They can draw their electrical power either from the trailer power units (manufactured by Clarke-Built, Ltd.), from a 230 V a.c. supply, or from a 117 V a.c. supply.



Marconi centimetric link equipment undergoing trials before shipment to Russia

Diesel-Electric Plant for Egypt

Against severe foreign competition Henry Meadows & Co. have secured a contract valued at £500,000 for diesel-electric generating sets from the Egyptian Government. The competing countries included Eastern and Western Germany and Czechoslovakia.

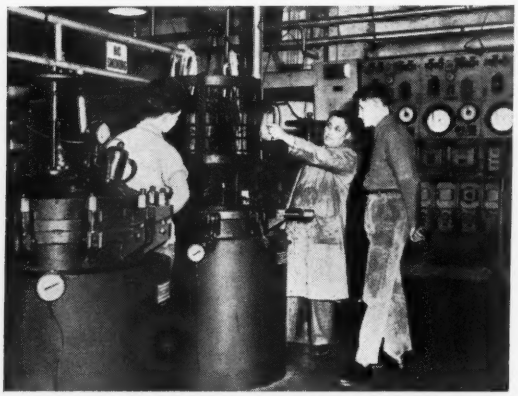
Material Price Increases in 1955

The *Board of Trade Journal* of 21st April publishes a review of the course of prices of industrial raw materials during 1955. Of the materials used in the electrical manufacturing industry raw rubber experienced the greatest rise—48·1 per cent. Copper rose by 37·2 per cent, copper tubes by 37·4 per cent, copper cold rolled strip by 35·8 per cent and copper sheets by 35·4 per cent. Brass strip and sheet went up by 32·5 per cent and brass ingots by 27·8 per cent. Zinc was 19·0 per cent higher at the close of the year while lead had risen by 8·8 per cent.

Electrical steel sheets (motor and generator) showed an increase of 6·1 per cent and heavy steel plates (over $\frac{3}{16}$in) one of 6·4 per cent. Iron castings cost 13·7 per cent more at the end of the year. For all materials used in the electrical machinery industry the price rise during 1955 was 16·3 per cent.

Apprenticeship Scheme

The need for trained engineers is pressing and still growing and most of the larger engineering concerns have realised that they must do their share of providing the engineers of the future. Individual companies of the Lancashire Dynamo group have long had training schemes and now the Group has com-



Apprentices under instruction at one of the Lancashire Dynamo Group factories

prehensive arrangements catering fully for modern conditions and requirements. In a new illustrated brochure ("Train as an Electrical Engineer") these arrangements are presented in an attractive way. A diagram shows the four classes of trainee—craft, technical, student and graduate apprentices—with ages and methods of entry; the first two classes are destined to become craftsmen and technicians respectively, while the other two are trained for positions on the technical staff. "Sandwich" courses are provided by some companies of the Group and in some cases there are arrangements for the interchange of students with such bodies as the Central Electricity Authority and the Admiralty.

Brief details are given in the brochure of awards and concessions, social activities and accommodation, and the nature of the work of the various companies is succinctly described and illustrated. Applications for entry to apprenticeship should be made to any company in the group or to the secretary, Lancashire Dynamo Group Apprenticeship Committee, St. Stephen's House, Victoria Embankment, London, S.W.1.

Machine Tool Factory Extension

An extension which more than doubles the production area has been completed at Smith-Richards, Ltd., of High Wycombe, Bucks, toolmaking factory of the Charles Colston group. The factory is equipped for high-precision work ranging from aircraft jigs to multi-stage tools which it is already supplying to industrial firms and Government Departments. It will also supply a large proportion of the tooling requirements for manufacturing the domestic appliances to be marketed by Charles Colston, Ltd.

George Ellison Offer

This is the golden jubilee year of George Ellison, Ltd., and the company has a museum in which it is proposed to place specimens of its equipment made between 1906 and 1910. In order to obtain good specimens of early equipment the company is offering to give modern gear in free exchange for certain equipment, and those wishing to exchange old gear for new can obtain details from any of the company's branches.

Battery Makers' Conference

A foremen's conference, at which directors, technicians, sales and other staff also attended, was held by Oldham & Son, Ltd., at Grange-over-Sands from 27th to 29th April. The conference was under the chairmanship of Mr. A. Eyre (executive director) and matters dealt with included production methods, foremanship and laboratory technique.

Batti-Wallahs' Luncheon

The State and national economy was the subject of an interesting address given at last week's luncheon of the Batti-Wallahs' Society by Mr. A. Shonfield of the *Financial Times*. Mr. W. C. M. Couch, president of the Society, was in the chair. Mr. Shonfield said that in the past year there had been indications of the Government's intention to exercise greater control over the national economy and he was of the opinion that this tendency would grow.

Mr. T. C. F. Bigland (the "Mate") announced that the next luncheon of the Society would be on 31st May when the guest speaker would be Admiral Sir Michael Denny.

Time Switch Courses

Over 400 representatives of Scottish Electricity Boards, electrical associations and electrical contractors were present at the Venner time switch maintenance courses held in Glasgow on 16th and 17th April and Edinburgh on 18th and 19th April. The first day was devoted to commercial and industrial applications which included a description of the new automatically controlled salmon pass at the Torr Achilty power station of the North of Scotland Board. Street lighting was the subject for the second day when different clock mechanisms were demonstrated and the latest automatic solar dials described.

Industrial Safety Training Centre

The Birmingham and District Industrial Safety Group has now obtained permanent premises for the Industrial Safety Training Centre at Summer Road, Acocks Green, Birmingham, 27. The lecture hall is equipped with power presses, capstan lathes, milling machines, grinding machines, lifting machinery and other equipment used in training, while the training hall will be used for the assembly of students and for lectures. It is equipped with a cinema projector. The Industrial Safety Group has issued a syllabus of courses which it proposes to run during 1956. These include courses for crane drivers and slingers; for foremen, supervisors, etc.; a course in electrical installation, repair and maintenance; for industrial truck, fork lift truck and other drivers; for power press toolsetters and allied personnel; and the use and maintenance of lifting machinery.

Trade Announcements

The following have been appointed to the sales staff of the lighting division of **Philips Electrical, Ltd.,** in the area covered by its Cardiff branch:—Mr. H. J. T. Owen, formerly a traveller for Vidor, Ltd., and Mr. G. L. Jones, formerly on the sales staff of Carreras, Ltd.

The new administrative office, showrooms and stores premises for **Monks & Crane, Ltd.,** at Garretts Green Lane, Sheldon, Birmingham, are nearing completion and will be formally inaugurated on 15th June.

Bristol Repetition, Ltd., Feeder Road, Bristol, 2, which specialises in work for the electrical industry, has again increased its capacity for the production of turned parts on automatics. A scheme has recently been introduced for the benefit of firms which require batches of turned parts at short notice, and delivery can be given in seven days where necessary. A further 14,000 sq ft of floor space is being added to the works as part of a development programme which will include the production of a machine tool unit to be known as the "Compass Mark VII" automation base. This is a machine of novel design which facilitates the construction of multi-operation, special purpose machines for the processing or assembly of small parts.

The northern area office of **Edmundsons Construction Co., Ltd.,** is now at 2, Hartley Hill, Leeds, 2. The telephone number (Leeds 33791) is unchanged.

J. A. Brown & Partners, Ltd., are now at 124, Livery Street, Birmingham.

Domestic Appliances at the Fair

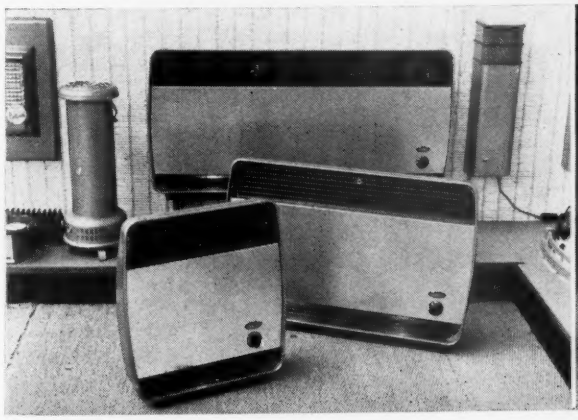
LOOKING round the various stands in the Electrical Section of the British Industries Fair at Olympia one is impressed by the high standard of display of the various manufacturers and it is hard to realise that when the doors close at 4 p.m. to-day this will be the last B.I.F. to be held in London. Although the number of strictly new appliances to be seen is not great, there are several interesting items which are exhibited for the first time.

The British Electrical Development Association occupies a prominent position in the Electrical Section, the theme of the exhibit being " Atoms in the Kitchen." The stand is entered through a corridor in which fluorescent lighted dioramas depict the various stages in the conversion of nuclear energy into electricity. Looking down from a raised platform a number of electrical appliances are seen apparently without any visible means of support. This is achieved by the use of fluorescent pigments and ultra-violet lamps. Also displayed are examples of the latest types of electric cookers and other household appliances, while another section of the stand is devoted to automatic time-controlled electric cookers, introduced by a puppet show.

Berry's Electric, Ltd., has several items on show for the first time which are very keenly priced. Over a hundred new types of lighting fittings are shown on this stand including contemporary wire pendant fittings with English glass liners. The metalwork is finished in white with black and yellow glassware. Alternative colours are red and grey.

The water heating section includes immersion heaters, and the popular " New Look " storage heaters. In addition to 1½ and 2½ gal heaters there appears for the first time a low-priced 3 gal model. Of graceful design it has a flush fitting back and is available in white, cream, pastel blue or pastel green. The loading is 1 kW and it is thermostatically controlled. New Berry fires include the 3 kW 555/C " Masterberry," equipped with curved radiator elements and coal effect, or if desired, log effect.

Above left: Chilton Electric Products spin dryer. Right: Part of the E.D.A. "Atoms in the Kitchen" exhibit depicting a range of automatic cookers. Below left: 1, 2 and 3 kW models of the Belling "Zephyr" range of convector heaters. Right: L. G. Hawkins new range of convector heaters: 1 kW model, "Junior Sunray" nursery heater and 2 kW heater



The finish is warm silver. For those who prefer the simplicity of a modern radiator but still wish to retain the visible warmth which an open fire can give, the new 333 " Masterglow " is available. A glow effect is seen through the lower louvres while above them, independently controlled, is a curved radiant reflector element assembly with a loading of 2 kW. The " Minorberry " is a low-priced 2 kW model, with half-heat switches and coal effect.

An entirely new range of low-priced heaters is also shown by L. G. Hawkins & Co., Ltd. They include a well designed 1 kW convector, in a range of six pastel tints, constructed of steel with aluminium die-cast feet. A 2 kW model is also available with either thermostatic or switch control. Another new heater is the " Junior Sunray," a 1 kW convector which can be had if desired suitably decorated for the nursery. Its design embodies copper coloured louvres with a glow effect. The new Hawkins 1 kW " Three-Way " fire is perhaps the cheapest model; it can be stood on a floor or mounted on a wall.

Bulpitt 3 pint whistling kettle

A new range of coloured kettles, a development of the " Family " 3-pint kettle introduced by Best Products, Ltd., is shown. The copper is enamelled in red, primrose, bronze or blue. Coloured handles are now fitted to the chromium " Family " kettle and the " Fanfare " alarm kettle. The company also displays the new " Jiffy " 2-pint kettle with a 1,250 W element. Other exhibits are a new electric blanket and an electric mattress overlay. Both are single size and have self-compensating elements which need no thermostats.

Included in a wide range of " Swan Brand " domestic appliances (Bulpitt & Sons, Ltd.) is a new whistling kettle. It has a capacity of 3 pints and a loading of 2 kW.

A new departure for Chilton Electric Products, Ltd., makers of " Buk " and " Kub " dry shavers, hair clippers, etc., is a portable electric spin dryer. Claimed to be the cheapest of its kind on the market, it is capable of drying six shirts, two single sheets or sixteen napkins at a time. As it measures only 23in high by 12in diameter it occupies little space.

Among many contemporary lighting fittings displayed by Oswald Hollman, Ltd., is a novel combined floor standard and coffee table.

Domestic equipment displayed by the General Electric Co., Ltd., includes the recently introduced electric cooker with accommodation on the hob for five medium-sized pots and pans, a 4 cu ft table top refrigerator with interior light, and the new range of " Cosyglo " fires. A new room air conditioner has been produced primarily for export to warmer climates but it is also available in a number of modified forms making it suitable for use anywhere. It has a capacity of 12,000 B.Th.U/hr and employs a sealed cooling circuit incorporating a 1 h.p. hermetically sealed motor compressor. The arrangement is such that a proportion of fresh outside air may be introduced at will and mixed with the recirculating air, both air streams passing through a nylon filter before passing through the cooling coil and discharging into the room. An electric heater or reverse cycle heat pump is incorporated in some models to cater for requirements in varying climatic conditions.

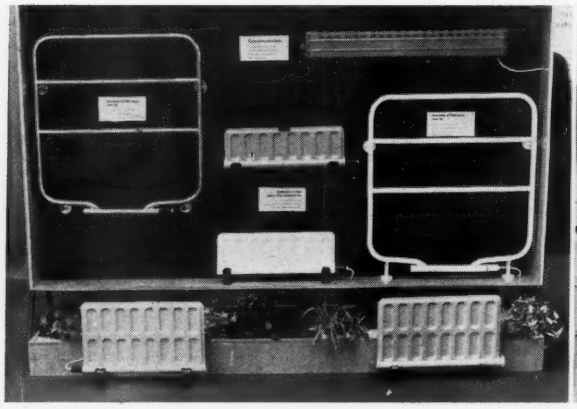
Several new products are shown by Dimplex, Ltd., in addition to their wide range of permanently oil-filled electric radiators. Among these is a 250 W towel rail, for wall or floor fixing, finished in chromium or an attractive range of colours. There are also a small heater with a loading of only 125 W designed for airing cupboards (a 250 W model is contemplated in the near future) and a skirting board heater. The latter measures 36in in length by 5in high and is provided with a 450 W ceramic packed, steel sheathed element. The standard finish is bronze.

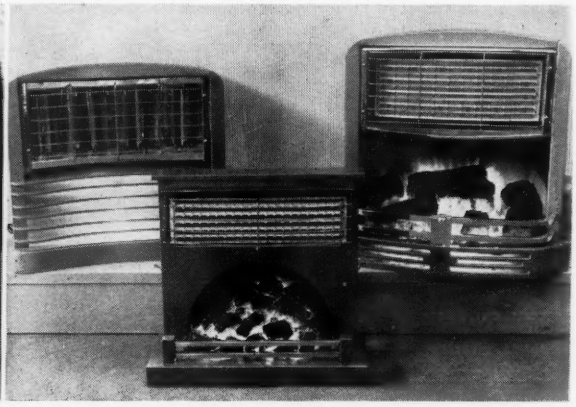
Two-tone bronze is the finish chosen for the new range of " Zephyr " convector heaters which take pride of place on Belling & Co.'s stand. The heaters are in 1, 2 and 3 kW sizes, and are fitted with heat reducing switches, or thermostats. A new range of cookers in eight colour combinations is also shown, the main emphasis being on the 47AB cooker with inner glass door and removable oven lining.

Although barbecues are not as popular in this country as in the United States, an infra-red rotary spit claimed to cook an average sized joint in less than an hour has created a fair amount of attention on Brattel Electric Co.'s stand. It has a loading of 1,400 W and automatic time switch and temperature control. A transparent slide-away shield allows a clear view of the meal being cooked.

All the main home laundry lines, washing machines, rotary and table ironers, clothes airers, etc., together with kitchen equipment and the new " Model 420 " vacuum cleaner are to be seen on the Hotpoint stand, which also displays a range of " Coldrator " domestic refrigerators. Hoover, Ltd., in addition to cleaners and polishers, show

Left: Part of the Dimplex display. Right: Newly introduced Berry's Electric fires: " Masterglow," " Minorberry " and " Masterberry "





H.M. the Queen visited Olympia on 25th April. In the left-hand picture she is seen with Mr. W. Percy McGeoch (left), chairman of the Electrical Exhibitors' Committee, and Sir Ernest Goodale (right), chairman of British Industries Fair, Ltd. In the centre picture the Queen is seen talking to Mr. Raymond Berry (Berry's Electric Magicoal, Ltd.). The right-hand picture shows Her Majesty and the Duke of Edinburgh with Mr. J. F. Perry (Metropolitan-Vickers) and Lord Chandos (chairman, Associated Electrical Industries, Ltd.) examining a model of Castle Donington power station

a recently introduced model of their "Mk. III" washing machine incorporating an electric heater. The double-stretch "Hooverflex" vacuum cleaner hose is also exhibited.

On the British Vacuum Cleaner & Engineering Co.'s stand particular attention is drawn to the "G.56" "Goblin Ace" model, a new product, together with two of the latest "Goblin" washing machines, "W.130" and "W.140," both of which incorporate a heater and automatic pump. A modified design of the Electrix floor polisher now has a foot-operated switch at the rear of the base of the machine.

Among the wide range of "Sectric" electric clocks shown is a new repeater alarm clock, the "Autocal" which is self-starting, has a luminous dial and rings alternatively for 25 seconds with a 5 second silent period.

DOMESTIC HEATING

Modern Methods Discussed at Institute of Fuel Conference

A TWO-DAY conference on domestic heating, arranged by the Institute of Fuel, at which 45 papers were presented for discussion, was opened on 1st May by Mr. David Renton (Parliamentary Secretary to the Minister of Fuel and Power). In an introductory address Professor Sir Alfred Egerton discussed developments since the issue in 1945 of the "Egerton Report." The purpose of that report, he said, was to gather information about possible improvements in heating standards as well as fuel efficiency and to point the way to means of achieving that end, but not to make definite recommendations. Later reports, e.g. those by the Simon (1946), Ridley (1952) and Beaver (1954) committees, had dealt with the application of heat.

There had been a slight increase in total fuel consumption for heating, Sir Alfred showed, as a result of the rise in living standards during the past ten years, which had involved an increased use of electricity. The crux of the domestic heating problem was better heat insulation of houses, which he regarded as having an importance at least equal to that of appliance efficiency; improvements were coming along too slowly. The extra cost incurred in avoiding heat loss would be negligible compared with savings in a very few years. Over-ventilation caused almost as much heat loss as thermal conductance. While 1½ air changes an hour was generally enough, twice that amount was often found even with closed windows.

In a review of the sources of domestic heat, present and future, Dr. G. E. Foxwell (chairman of the conference organising committee) referred to the need for architects to design houses round the heating system, which would increase materially the overall efficiency of heat utilisation.

Improvement of load factor through electrical thermal-storage heating of buildings provided the subject of a paper by Mr. J. W. Moule (South of Scotland Electricity Board). He pointed out that an off-peak tariff available for only a few hours by night would give the lowest kWh charge, which however would be more than offset by the cost incurred by consumers in providing thermal storage. Such a tariff should place as little restriction as possible on electricity supply, even if the kWh charge were thereby somewhat increased.

Water and concrete were the most commonly used heat-storage media. Electrode boilers, usually of 20 kW (70,000 B.Th.U/hr), had been installed in several hundred central heating schemes in South Scotland. For new buildings, heating cables run in ducts in solid concrete floors gave all the advantages of low-temperature radiation, including reduced heat losses. The application of floor heating to the living rooms and halls of 48 two- and three-apartment flats in an eight-storey block recently erected by Kirkcaldy Corporation was described. To supplement this heating in very cold weather and for intermittent use in the summer, a 2 kW electric radiator was installed in the living room. A 42-gal storage water heater was also supplied off-peak.

The expected average weekly cost of electricity was 17s 8d for the larger flat and 12s 10d for the smaller,

allocated as follows: Floor heating, 6s 5d and 5s 3d; hot water 4s 9d and 2s 5d; electric radiator, 2s 10d and 2s 6d; cooking 1s 11d and 1s 5d; lighting, etc., 1s 9d and 1s 3d. For 600ft of floor area 8 kW was required and the entire capital cost was about £200, or about half the cost of a solid-fuel or gas-fired system, allowing for building accommodation and boiler flues.

Electric Heating Economics

Economics of the domestic heating load were dealt with by Mr. O. W. Humphreys (General Electric Co., Ltd.), who first specified with the aid of numerous graphs a series of conditions that would yield varying degrees of comfort in relation to the quantities of heat required to maintain those conditions. There could, he showed, be no unique specification for environmental conditions conducive to comfort in view of differences of opinion between individuals as to the combination of convected and radiant heat that suited them best.

To the economist the advantage rested entirely with the system that called for the lowest continuously maintained temperature. Broadly speaking, a temperature of 65 to 70 deg F would be required in a room heated by convection alone, while 55 deg F supplemented by radiant heat when the room was in use gave the optimum combination of comfort and economy, provided the radiation was properly distributed.

Electric heaters, whether radiant or convective, had an efficiency of 100 per cent. The radiant efficiency of gas fires was probably over 50 per cent nowadays and of old-fashioned coal fires seldom more than 15 per cent. Test-bed efficiencies of post-war designs of solid-fuel appliances had exceeded 40 per cent at low burning rates, but in practice allowance had to be made for raising the temperature of air passing through a room in excess of that required for ventilation. With an average temperature rise needed in this air of 20 deg F, the effective efficiency would become about 30 per cent for coal fires and 35 to 40 per cent for coke fires under carefully controlled conditions. Lack of flexibility of solid-fuel fires, which produced more heat than was theoretically necessary, would probably reduce these figures to 25 and 30 per cent. Overall efficiencies of central-heating installations were generally between 40 and 60 per cent.

Coal, coke and gas had increased in price by approximately 40 per cent since 1948 compared with 16 per cent for electricity which reflected an increasing generating efficiency. The earlier nuclear power stations were expected to produce electricity at about the same cost as modern coal-fired stations but at a lower cost with technological advances, whereas the price of coal would almost certainly increase.

For intermittent heating, the cost of domestic heating was substantially the same with electricity at 1d/kWh, coal at £8/ton, coke at £8 5s/ton and gas at 1s 9d/therm. For continuous heating electricity cost the same as gas at 1s 6d/therm and twice as much as coke at £8 5s and 40 per cent efficiency.

Surveying the development of electrical domestic heating appliances, Mr. E. M. Ackery (British Electrical Development Association) referred to the importance of personal incomes on heating habits. The problem was therefore not so much one of providing a definite temperature in a given space for a given time as of furnishing the householder with as much comfort as possible in the form he required at a price he was prepared to pay.

Well over half the homes in Britain had one or more electric fires, usually either of the fire-bar or the reflector type, which differed in the method of mounting the element and controlling the heat emitted. The first type might emit 50 per cent of its output as radiant heat, the remainder warming the air by convection. The second concentrated up to 70 per cent in a beam, the reflector remaining relatively cool; it thus gave quicker results for occasional use. The old allowance of 1 W/cu ft would not be enough for living rooms, but could be adopted for occasional warming of other rooms.

Low-temperature tubular heaters loaded at 60 W/ft run, reaching a surface temperature of 200 deg F in 10 to 15 min, normally radiated 27 per cent of their output from the front only. Portable convectors (0·75 to 3 kW), radiating 8 per cent of their output, gave a less good heat distribution but did not blacken walls. Electric hot-water radiators with similar loadings had surface temperatures ranging from 120 to 180 deg F, the proportion of radiant heat varying from 15 to 50 per cent in different designs.

With low-temperature panel heaters, surface temperatures varied from 120 to 250 deg F and loadings from 80 to 180 W/sq ft. Embedded cables operated at 100 deg for walls and ceilings and at not more than 75 deg for floors. Except for intermittent use, thermostatic control was necessary with panel heating. After noting the most suitable heating conditions and apparatus for the several rooms of a house, the author discussed hot-water supplies, pointing out that in large houses and blocks of flats a number of smaller heaters might be more economical than one large central heater. The conclusion was reached that the next decade would show a steady increase in the amount of electricity used for domestic space and water heating but no significant change in the way in which it was used, with the possible exception of heat-pump development.

The Pimlico Scheme

Proceedings on the second day of the conference were opened by Mr. J. E. Powell (Parliamentary Secretary of the Ministry of Housing and Local Government). The programme included a discussion of the paper on the Pimlico district heating undertaking which Messrs. B. Donkin, C. M. Johnston and E. Ockenden presented at a joint meeting of the Institution of Electrical and Civil Engineers on 31st January (*Electrical Review*, 10th February). This paper gave the costs of construction and financial results of operation in the twelve months ended 30th September, 1953, as the only year to date in which a constant number of premises was supplied with heat. The conclusion reached was that the economies of combined electricity and heat generation depended on the development of inexpensive methods of heat distribution and the existence of concentrated demands for heat. An improved thermo-dynamic cycle, however, would have effected an appreciable reduction in the net cost of heat.

In another paper, sponsored by the Electrical Association for Women, it was suggested that new methods of heating should be judged by the alleviation they brought to the housewife. This entailed a fresh approach to the whole problem and not a patching up of obsolete methods. One line of inquiry would be to select the most suitable from all modern heat sources and controls and to apply them not according to tradition but experimentally in ordinary living conditions. In this connection reference was made to the investigations carried out by the Building Research Station of the D.S.I.R. at Abbots Langley and by the Central Electricity Authority at Keadby, Yorkshire. The hope was expressed that houses would be built with three-dimensional heating, i.e. floors, wall and ceiling, supplemented by radiant heating, with adequate controls, including thermostatic and time mechanisms. Heat pumps for house warming were also mentioned as a desirable possibility of the future.

Electrical Research

Further Income Needed to Finance E.R.A.'s Growing Activities

THE thirty-fifth annual report of the British Electrical and Allied Industries Research Association was published this week, covering the year 1955. Both income and expenditure showed an increase over the previous year but although the growth of expenditure was greater than the growth of income the year finished with a fractional surplus. Government support through the Department of Scientific and Industrial Research is on a basis proportional to the contributions made by industry up to a specified maximum, and this year the maximum grant was earned. First steps have been taken regarding a renewal of grant, and although the results of the application cannot be anticipated it is known that over the next five years the ratio of grant to grant-earning revenue will be appreciably less than under the present generous terms. In view of this, and of the better facilities shortly becoming available at Leatherhead, serious thought is being given to methods of securing the additional income which will be necessary if the work is not to suffer.

Since the report was drafted the Government has introduced the Department of Scientific and Industrial Research Bill. This replaces the present committee of the Department by an executive council and provides for its expenditure to be met by Parliament. There will therefore be some change in the mechanism whereby Government support is given to the E.R.A. in common with other recognised research organisations. Whether or not this makes any difference to the magnitude of the support, it cannot help injecting some element of uncertainty into the situation and might even result in Parliament taking a closer interest in the doings of such organisations.

No change has been made in the general structure of the Association's organisation. Under the Council's direction nearly one hundred sub-committees and panels regulate the research work under twenty different section headings. Their membership is drawn from a very wide field, and this form of organisation enables experts in every sector not only to contribute from their experience but also to assist in disseminating the results of the research to their colleagues in industry.

After serving for the normal period of two years Mr. C. T. Melling retired during the year from the chairmanship of the Council, his place being taken by Mr. F. H. Bramwell, until recently chief engineer of Imperial Chemical Industries and director of the Power Gas Corporation. The year also saw the retirement from the Council of Dr. C. W. Marshall and of Mr. J. E. Calverley both of whom have been associated with the E.R.A. for a quarter of a century, the former having been the Council's chairman from 1940 to 1942.

Researches and Reports

The year's work is classified under seventeen main headings most of which can be related either to materials, apparatus, or what might be called operations. Progress is reported under each head, and it is only possible here to mention some of the more outstanding. Under insulation, reference is made to a new form of intrinsic breakdown that has been discovered arising from instability in the electrostatic field. Hitherto accepted values of electric strength at higher temperatures will need revision. A final report on the stabilisation of paper capacitors has been issued, and the dry aluminium capacitor has reached the development stage. Tests have been made of the dielectric properties and thermal endurance of nylon and "Terylene," and of corrosion in more traditional insulating materials. Regarding cables, new E.R.A. rating tables for paper and varnished cambric cables were issued during the year. These enable advantage to be taken of the higher agreed temperature for certain types, of variable loading, and of improved knowledge of the thermal properties of the soil. On overhead lines, a book was published on electrical characteristics which has been accepted as an authoritative handbook on British practice.

Under circuit-breaking, studies have been completed on the axial air-blast circuit-breaker, and tests made on air-break, gas-blast and oil breakers. Facilities for synthetic testing have been extended to the equivalent of 50 kA at 10 kV. The survey of rates of restriking voltage has been extended using the network analyser, which has also been in use for a number of members' problems: most of these were found to require the exceptional versatility which this equipment provides. Finally, it is interesting to note that a vacuum switch has successfully interrupted the full output of the Perivale test plant.

Under the heading of steam and high-temperature steels the plant for extending the steam tables to 5,000 lb/sq in and 1,400 deg F is almost ready. The test rig at a new C.E.A. power station will test circumferential welds in large steam pipes. Long-period tests on steam components and tests on a number of new alloys are included in the programme. Work on surges and surge recording has continued, a summary of lightning fault statistics for 1950/55 has been issued and a five-year map of lightning activity is being prepared. Other researches of an operational character include work on interference and on earthing and safety. On transformers, work continues on the noise problem, and a small experimental substation is in use for studying the ventilation of transformer cubicles.

The work on wind power has attracted world-wide attention and under the sponsorship of various international organisations E.R.A. staff have visited and maintained contact with work on wind power initiated in Israel, India, the Falklands, Somaliland, South Australia, Trinidad, Haiti, Tobago and Spain. Typical of the interest shown is a UNESCO request for a scheme for a combination of solar energy, wind power, and local sources for an arid area community.

In the section dealing with rural electrification a number of useful researches have been continued and others started. The thermal efficiency of drying agricultural and horticultural materials has been improved and a multi-purpose farm dryer is in successful operation. Work continues on increasing winter egg production by flashes of light, and on light sources for tomato and lettuce seedlings. There has been further development of the widely used soil-warming techniques. Other subjects include the effect of electric currents on plants, electric fishing and the destruction of wood and grain pests in high frequency fields.

Under heat pumps and heating, a detailed study has been made, in co-operation with the C.E.A. of the performance of large heat pumps in generating stations. The

double-purpose domestic heat pump is in commercial supply, but operational research continues and the air as a heat source is being studied. Work on the economical drying of household laundry is nearing completion, and further research has been done on floor heating.

Perhaps the most intriguing looking of the sectional headings is that entitled " Unclassified Researches " and ranging from astrophysics to the storage and generation of electrical energy. In this section come fuel cells on which further work has been done on the hydrogen-oxygen type. Studies are in hand of applications which may prove economically attractive. Further research work is also reported on welding, on resistors and on alternator and motor losses.

Work on sheet and magnetic steels is largely done by outside bodies with whom the Association keeps in close touch. These include the British Iron and Steel Research Association, the Permanent Magnet Association, the National Physical Laboratory and several of the universities.

Realising the urgency of the particular problems of flame-proofing electrical apparatus and intrinsic safety of equipment, the Government has promised a generous contribution to enable a more comprehensive programme of research on this subject to be put in hand, and a new sectional committee has been established to co-ordinate the work. Financial contributions to this programme have also been made not only by the manufacturers of equipment but also by users, namely, the oil industry and certain sections of the chemical industry which have a special interest in this subject. The supply industry and the turbine, boiler and pipe manufacturers have similarly financed an urgent programme on the behaviour of components under high pressure at high temperatures in the obvious interest of increased fuel efficiency. A new subcommittee has also been set up to investigate the possible uses of alloys of titanium in the construction of steam turbines.

Eighty-one new reports were issued to members during the year. In order to aid internal dissemination by members, advance copies of summaries were made available, and members were entitled to ask for as many copies of these summaries as they required to distribute to their staff. The information bureau has dealt with a large number of technical questions from members, prepared bibliographies and lists of references and compiled a weekly list of abstracts. The translation service has made some 65 translations during the year for members and staff, in addition to providing abstracts from foreign journals. The number of loans of journals arising out of the weekly abstracts has amounted to about 7,000 during the year, which is clear evidence of the interest taken in them.

Leatherhead Project

Both the financing and the construction of the Leatherhead laboratories have proceeded well in accordance with expectations. Capital contributions amounting to £201,500 have now been paid, which exceeds by a small margin the sum required to secure the D.S.I.R. capital grant of £100,000. Good progress was made on the buildings throughout the year and an advance guard of the Association's staff has been operating from Leatherhead for some time past. The main body is expected to move in some time in June. No date is given for the complete vacation of the Perivale premises but this will doubtless not be long delayed. When the move is completed the Association will enjoy the luxury of operating from a single centre with a tailor-made establishment and vastly improved facilities.

Included in the equipment of some of the buildings are various experimental forms of electric heating including hot water storage with immersion heaters, floor heating and portable storage heaters. In future winters it will be possible to study the effect of these on the Association's own domestic economy.

Utilisation of Results

Some years ago concern was expressed that the results of the Association's work were insufficiently publicised, and that in consequence much valuable information was either not reaching all potential users or else was imperfectly understood so that the fullest use was not being made of it. It was therefore decided that from time to time attention should be directed to particular topics, and meetings should be arranged with members to describe and discuss informally progress in specific fields. The aim of these meetings would be to secure the more efficient use of the results of E.R.A. work by industry.

The first of these special efforts was made in 1954 when a group discussion on electric fuses was arranged. Recent reports on fuses were introduced to representatives of interested members, and a useful discussion followed. Arrangements are now in hand for the second of these group discussions to take place during 1956. The subject will be the application to manufacturing processes of recent work on the detection of incipient failure of insulation. A similar purpose was served by the paper presented to the Utilisation Section of the I.E.E. in January entitled " Age and the Incidence of Fires in Electrical Installations."

In addition to these special efforts, all the regular avenues of technical liaison have been fully utilised throughout the year. The Association took an active part in a number of exhibitions and displays, including the Electrical Engineers' Exhibition, the Physical Society's Exhibition, the Institution of Electronics Exhibition at Manchester and the Electronics and Productivity Exhibition at Glasgow. A number of reports were prepared for the technical Press describing recent E.R.A. reports, and many articles of a more general character by the Association's staff have been published in technical journals both here and abroad.

Ultrasonic Testing

IN ultrasonic testing by the pulse reflection or pulse transmission methods it is desirable to be certain that the complete ultrasonic equipment is operating under conditions of reproducible sensitivity, so that the amplitudes of defect echoes may be directly compared while tests are in progress. This is particularly important in the following cases: (a) After valve replacements; (b) when adjustments have been made to the apparatus; (c) if the instrument has to be interchanged with another similar instrument. It is further desirable to be able to make spot checks on the instruments under working conditions in order to ensure that the sensitivity is not affected by changes in the mains voltage, valve emission and crystal mountings, or by wear of the probe surface.

In view of this the British Standards Institution has prepared B.S. 2704: 1956 which deals with reference blocks for routine checking of ultrasonic testing equipment employing sheer wave probes. The simple reference block of the type specified is no substitute for full laboratory calibration of the electrical as well as acoustical variables involved. It is, however, considered that the block can serve a useful purpose by permitting rapid checks to be made on the instruments, so as to enable a reasonable degree of confidence to be placed in the reproducibility of the results obtained. It is emphasised that a reference block should not be treated as a standard defect and therefore cannot be used to estimate the magnitude of defects. Copies of the Standard can be obtained from the British Standards Institution, 2, Park Street, London, W.1, price 2s.

Radio Astronomy

The Forty-Seventh Kelvin Lecture

WHEN he delivered the forty-seventh Kelvin Lecture at the Institution of Electrical Engineers in London last week Professor A. C. B. Lovell chose radio astronomy for the subject of his discourse. He said that during this year we might see the use of one of the largest instruments ever made for scientific research, the radio telescope now being constructed at Jodrell Bank, Cheshire. Professor Lovell explained that the reasons for constructing this telescope, which had great gain and high resolution, covered many wide fields of application in the new science of radio astronomy, including the study of radio emissions from the galaxy in an attempt to solve the problem of the origin of those radio emissions and the nature of the radio stars.

The decision to build the radio telescope at Jodrell Bank was taken in 1949 at a time when many countries did not believe that the solution of the problem depended upon the steerable telescope of such magnitude. To-day, the United States was spending $35 million on building a large telescope, the Russians already had the largest, and the Australians were also building one.

Professor Lovell showed a short film and some slides which illustrated some of the constructional features of the telescope. If, as was hoped, tolerances in the bowl were kept to $\pm\frac{1}{2}$in, he said, there would be a gain of about 50 million in the 10 to 20 cm waveband. Even at $\pm$1in the instrument would be very powerful in the 20 cm waveband. Guidance of the telescope might prevent the deployment of the rather low wavelength. It was hoped to have a motion which would be accurate to the order of about 6 minutes of arc.

Principal Investigations

Dealing with one of the major problems which it was hoped the telescope would help to solve, Professor Lovell showed some plots which had been obtained in Cambridge of a number of radio sources against their intensity. An interesting feature was that there were very good grounds for believing that most of the radio sources were extra-galactic and were probably collisions. The results of the plots were quite different from those which might be expected if the sources were distributed uniformly in space. In other words, there appeared to be many more faint radio sources than one would expect if their distribution were uniform. The radio telescope would be used to measure the distance of those remote sources which were believed to be cases of collision.

Other important problems which it was hoped to study with the telescope were not concerned with the reception of radio waves from space, but with radio echo or radar techniques, because the radio telescope was an extremely powerful instrument of the radar type. So far as long distance radar was concerned, there was already an apparatus working at 120 Mc/s with which echoes from the moon were studied. The delay was $2\frac{1}{2}$ seconds, and the return signal from the moon had a quick period fading and a slow period fading. The equipment was being used to study the total electron content in the E and F Regions.

The new radio telescope would also be used to study the planets, particularly Venus, from which it was 10 million times more difficult to obtain a signal than from the moon. It was hoped to overcome that difficulty with the use of the great gain of the radio telescope. Unfortunately, it was not possible to use a very long pulse because the effective radar depth of Venus was only 40 milliseconds. Nethertheless, it seemed to be a feasible programme and one which would be attempted.

Then there were the problems of the radio investigation of meteors, both the astronomical and physical aspects. It was an interesting fact that something of the order of 10,000 tons of meteoric debris were swept up every day by the earth. A few hundred tons got through and hit the earth as meteorites, but the remainder was burned up in the atmosphere. Nobody knew where that debris was coming from, and there was the cosmological problem of finding out whether the debris was something left over in the solar system or the result of some subsequent disintegration. The radio telescope would again be used for that type of problem.

Finally, the radio telescope would be of great advantage to this country in the International Geophysical Year. Great efforts would be made to bring it into full working use before next June, and the programme, apart from celestial problems, was very considerable. It involved a study of the details of the Aurora Borealis, and also the study of the solar corpuscular stream. "I should like to express the hope," concluded Professor Lovell, "that it will be the privilege of someone in the future to deliver a Kelvin Lecture and in it to tell you how far our hopes have been realised with this telescope."

A vote of thanks to Professor Lovell, proposed by Professor E. B. Moulin, M.A., Sc.D., and seconded by Dr. Willis Jackson, D.Sc., Dr.Sc.Tech., F.R.S., was carried by acclamation.

Installations in Caravans

IN response to an approach by the National Caravan Council and inquiries from individuals, the Wiring Regulations Committee of the Institution of Electrical Engineers investigated the application of the Regulations to trailer caravans using mains electricity supply. They concluded that the existing Regulations should be observed for caravan installations in so far as they applied, but, in order to clarify and extend the application of the Regulations to the special circumstances involved, a memorandum entitled "Recommended Practice for Electrical Installations in Caravans" was issued, with the approval of the Council, on 1st February, 1954, and received wide acceptance.

Following the issue of a revised (13th) edition of the full Regulations on 1st September, 1955, the recommended practice was revised in minor details to accord with the new Regulations, and a second edition of the recommendations has now been published to take effect from 1st May.

The recommendations deal in particular with methods of connection of the electricity supply and with provisions for earthing. The installation of an earth-leakage circuit-breaker in every caravan is recommended, and the text of a notice, "Instructions for Electricity Supply," is given, which it is recommended should be fixed near the main switch, giving advice to the user.

Copies of the booklet may be obtained from the Institution, 2, Savoy Place, London, W.C.2, price 1s 3d including postage.

The M.V. "Bergensfjord"

The 17,000-ton M.V. *Bergensfjord* of the Norwegian America line, recently completed at the Wallsend yard of Swan, Hunter & Wigham Richardson, Ltd., is said to be the first passenger ship built in Great Britain with all auxiliary services operated by a.c. All the generating plant and engine room switchboards, protective relays and over 90 squirrel-cage motors in sizes from ½ h.p. to 335 h.p. have been supplied by the General Electric Co., Ltd. The supply is at 440 V, 3-phase, 60 c/s, and distribution is by an earthed neutral system with an earthing resistance which prevents the earth fault current exceeding about 500 A.

Each of the four main generating sets is a 1,040 kW, 450 V alternator direct-coupled to a Ruston & Hornsby diesel engine.

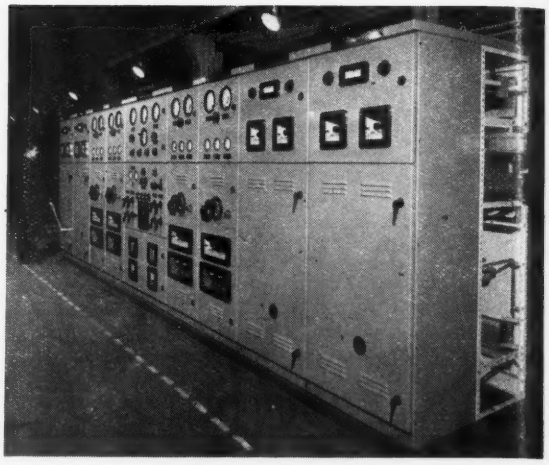
The main switchboard has an overall length of 64ft. Its central section comprises the alternator control and synchronising panels, while the remainder of the board accommodates feeder control switchgear and motor starters. Most of the remaining starters are in separate port and starboard group boards in the main engine room.

The main circuit-breakers and those for the scavenger blower motors are electrically closed, the solenoids being supplied through transformer-rectifier units. The other grouped motor starters are energised by a 110 V a.c. supply derived from single-phase transformers in the main and group boards and are operated from push-button stations adjacent to the machines concerned. Certain machines are controlled from local push-button starters. All machines are started direct-to-line except the stabiliser motor (rotor-resistance starter), the turning gear motor (series resistance starter) and the 22 h.p. emergency bilge pump motor, which must be able to operate on the 80 kW standby supply and is therefore designed for a low starting current.

The 38/37 h.p. ballast pump motor is a two-speed machine. If the high-speed starter button is operated, the motor runs up in the low-speed connection and is then changed over automatically to full speed.

A separate 15-panel oil service board is installed for control of the two 35 h.p. transfer pump motors and the seven purifier motors.

The ship is equipped with a Denny-Brown stabiliser, for the operation of which the G.E.C. has supplied a switchboard, a 50 h.p. slipring motor and a 10 h.p. squirrel-cage machine.



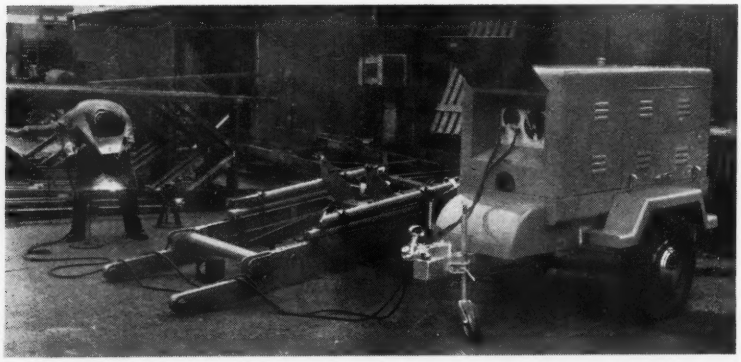
Works picture of the central section of the 64ft main switchboard

Mobile Welding Trailer

A number of improvements are incorporated in a new mobile electric arc welding set, the Mark 300T, announced by the Power Division of Clarke-Built, Ltd., Power Road, Chiswick, London, W.4. The equipment has an Armstrong-Siddeley twin cylinder, direct injection, air cooled diesel engine of 14/22 h.p.; a welding generator by Lancashire Dynamo & Crypto, Ltd., with an additional bank of unbreakable, rustless and incorrodible continuous strip resistances, giving a finer selection of the welding range; and the whole of the control gear mounted on top of the generator is so arranged with the generator end cover as to direct and circulate forced cooling air through the whole of the control gear.

In the new welding set the control handle for operating the main current selector switch has been modified to make it much easier for the operator to select and control his welding range position.

High-speed trailer type of arc welding set



Aluminium Welding

The Aluminium Development Association has issued a new information bulletin (No. 19) concerned with the practice of all the electric arc welding processes applicable to aluminium.

Notes on factors governing the welding arc in general precede a brief description of the characteristics of aluminium in relation to arc welding, and this leads, in turn, to a discussion of the weldability of aluminium alloys by the various arc processes. The first principal section of the bulletin, on inert-gas shielded-arc welding, deals first with the tungsten electrode and secondly with the consumable aluminium electrode process. A series of tables giving recommended operating data for stated thicknesses of parent metal includes such matters as edge preparation, pre-heating if necessary, electrode and filler wire diameter, current range, gas consumption and welding arc speeds. In the section on metal-arc welding diagrams illustrate the type of joint recommended for metal-arc welding and those not recommended unless the use of corrosive fluxes can be avoided. The process of carbon arc welding, very largely superseded in this country, is briefly described. Atomic hydrogen welding, although involving the use of an electric arc, is regarded as belonging more appropriately to information bulletin No. 5 "The Gas Welding of Aluminium" and is therefore merely noted here as a cross-reference.

The bulletin is available from the Aluminium Development Association, 33, Grosvenor Street, London, W.1, price 2s 6d.

GENERATION AND DEVELOPMENT

E.D.A. Committee at M.E.B. Industrial Centres

Members of the Industrial Committee of E.D.A. visited the Midlands Electricity Board on 17th April to study two features of the Board's service to its industrial consumers—the industrial development and appliance testing centre at Springsmire, Dudley, Worcs, and the industrial showroom at Chester Street, Aston, Birmingham. The party was led by the committee chairman, Mr. L. Howles, chairman of the South Wales Electricity Board. The visitors were received by the chairman of the Midlands Electricity Board, Mr. W. S. Lewis, and were accompanied on their tour by the Board's chief commercial officer, Mr. H. J. Gibson, and other M.E.B. officials. At Springsmire the visitors saw a demonstration of the work of the industrial development laboratory, established in September, 1955. The industrial showroom at Aston, which also has floor warming and special lighting, was devoted to an exhibition of modern welding techniques.

Accident at Hams Hall

When a 30ft high ferro-concrete structure being erected inside a 350ft cooling tower at Hams Hall "C" generating station collapsed last week men working on the structure were thrown from the staging, some being trapped under debris. Fourteen of the workmen were injured, eight being detained in hospital. An official of the C.E.A. Midlands Division stated that apparently the internal columns had spiralled and collapsed. The structure was for supporting the wooden latticework inside the tower. Precast concrete vertical members had been raised into position and the structure was being temporarily staged from tubular steel scaffolding while concrete ties were installed.

Expansion in "Manweb" Area

At its meeting at Llandudno on 26th April the Merseyside and North Wales Electricity Consultative Council heard a statement on the Board's progress during the twelve months ended 31st March last.

The maximum simultaneous demand was nearly 1,008,000 kW, compared with 915,000 kW in the previous year. In 1948/49 it was 632,000 kW. Over 4,000 million kWh was supplied to consumers, nearly 400 million more than in the previous year. The popularity of electricity for cooking, water heating and other domestic uses continued to grow and during the year the Board installed about 15,000 cookers, 18,000 water heaters, 8,500 washing machines, 8,500 cleaners and 2,500 refrigerators.

The Board's customers now numbered more than 841,000, compared with 813,000 a year ago and 632,000 when the Board came into existence in 1948. There were more new connections of farms (1,863) than in any previous year; this compared with the planned annual average of 1,270. The Board regretted that this rapid rate of progress of rural electrification could not continue in the present year as it would be out of keeping with the Government's call for a curtailment of the country's capital expenditure, but the Board hoped to be able to connect about 1,200 farms.

During 1955-56 more than 470 miles of high voltage and 300 miles of medium voltage mains were laid or erected and nearly 35,000 new service lines were installed.

Overland Cable

A new departure by the North of Scotland Hydro-Electric Board—laying cables overland instead of using pylons—was welcomed by Inverness-shire Planning Committee on 16th April. The Committee gave permission to the Board to lay an overland sheathed armoured cable from Invergarry generating station to the Falls of Garry, some five or six miles to the west. The cable will lie on top of the ground for most of the way. Where it has to go underground, it will be laid 6in deep and where it crosses rivers it will be clipped to bridges.

Mobile Cranes for Lighting Standards

A recent addition to the range of Coles mobile cranes, designed and manufactured by Steels Engineering Products, Ltd., is Model L410, which has been chosen by the Lanarkshire County Council primarily to assist in the erection of lighting standards.

The method of erection is to make the required number of holes, leaving the excavated earth by the side of each hole. The standards for each area are left all together in a suitable spot and a day later the crane raises each standard, erects it accurately in the hole and moves on to the next one while a workman fills in the cavity with earth and firmly cements the standard in place.

Manually, only four or five standards could be erected per day by a team of 10 men; now 14 men and the crane will erect as many as 42 in a day, including travel of about 60 miles.

The crane is truck-mounted, full-circle-slewing, diesel/electric and fully mobile. The three crane motions —hoisting, derricking and slewing—are each powered by separate electric motors energised by d.c. from a variable speed generator, coupled direct to a diesel engine. These motions may be used individually or simultaneously, and self-resetting limit switches are fitted to the hoist and derrick motions. Automatic electro-mechanical brakes are also fitted to hoist, derrick and slew motions.

Erecting a lamp standard in Lanarkshire

The power unit is a Perkins diesel engine or a Ford petrol engine as required. Fitted with a standard length 20ft cantilever jib of lattice construction, the lifting capacity of the crane is 3 tons at 10ft radius.

Nuclear Power Station Inquiry

A public inquiry was held last week by Mr. H. W. Grimmitt, chief engineering inspector, Ministry of Fuel and Power, into the plan to build a nuclear power station at Bradwell-on-Sea, Essex, at a cost of some £25 million. There were nearly 400 objectors.

Mr. H. Willis, Q.C., for the Central Electricity Authority, said that the site was eminently suitable for such a station, which needed a good foundation for the heavy reactors and plenty of water for cooling. The site was in accordance with the Government's policy that the first atomic power stations should not be in heavily built-up areas, though the station would in fact have a very high safety factor. The site was near a wartime airfield and, while Bradwell had certain attractions, no one could say that the site on which the station was to be built was a beauty spot. Many of the objectors did not come from Bradwell and it was plain there was a good deal of organised opposition. There had only been 34 objections from Bradwell, with a population of 600. He considered that damage feared to the oyster fisheries had been greatly exaggerated.

Mr. P. T. Fletcher, deputy director of engineering of the Industrial Group of the Atomic Energy Authority, pointed out that the effluent discharged into the estuary was based on a safe international standard.

Mr. Julian Snow, M.P., suggested that 15 miles away was a Government site, the usefulness of which would be disappearing in the immediate future, which should have been considered.

Mr. John Betjeman, poet and author, one of the objectors, who lives at Wantage, Berks, said he attended voluntarily because Essex had always been his favourite county and because of the importance of siting. The Bradwell area was one of two places left better than anywhere in the South of England for mild, pastoral scenery. The other was Thaxted. The effects of an enormous power station would be felt much further than they would at the Authority's other site in Gloucestershire because the skyline counted so much more. The Bradwell site was " three-quarters sky."

Mr. P. E. Brown, secretary of the Royal Society for the Protection of Birds, expressed fears about the effect of effluent on the feeding grounds of the dark-breasted Brent geese, more than half of the world's stock of which wintered in this country, 75 per cent going to the area near where it was proposed to build the station.

Mr. Grimmitt assured several objectors that water supplies would not be impaired.

The inquiry was adjourned until 8th May.

Council Meets at Power Station

The April meeting of the Southern Electricity Consultative Council was held at Marchwood generating station, by permission of Mr. R. H. Coates.

Mr. R. R. B. Brown, chairman of the Board, explained the present position regarding capital expenditure. He said that the Board's estimate of £8 million had been reduced by £1,050,000, which it was proposed to achieve by deferring £470,000 expenditure on depots, offices, service centres, vehicles, tools and equipment; £85,000 on system reinforcement and bulk supply points; £395,000 on new supplies; and £100,000 on supplies to domestic premises already connected to the gas supply. With regard to houses served with gas, Mr. Brown said that if only a service connection from an existing l.v. distributor was required, supplies would be given where existing facilities for heating or cooking were worn out or where serious hardship would otherwise result.

Uganda Board's Distribution Plans

The next stage of the Uganda Electricity Board's distribution programme will make supplies of electricity available initially to nearly 500 premises. A 33 kV line is to be erected westwards from Kampala to Mityana and then southwards to join up with the existing Kampala-Masaka line, some 35 miles south-west of Kampala, to form a ring main. Over 100 miles of line will be constructed, including several spur lines to serve places off the route of the main lines.

In addition to the township of Mityana and other places, hospitals, coffee factories and hulleries, tea factories, ginneries, maize mills, oil mills and saw mills will be supplied.

Besides this scheme, the Board recently approved a 35-mile extension northwards from the Kampala-Bombo line to give supplies to some 200 consumers, including cotton ginneries, oil mills, and the Bukalasa Agricultural Station, as well as a number of villages.

The capital cost of these two distribution schemes, which will take about five years to complete after construction starts, is estimated at nearly £350,000. Premises will, however, be connected as far as possible as the lines are erected. The main lines are of sufficient capacity to deal with the requirements of many more than the 700 consumers expected to be supplied from the two schemes in the first few years.

Scottish Railway Electrification

Over 70 miles of Glasgow suburban railways are to be electrified at a cost of over £13 million. An announcement by the British Transport Commission states that work will begin in nine months' time on the first section, the line between Helensburgh and Airdrie through Glasgow with connections to other stations north of the Clyde. Later it is intended to deal with the lines to the south of Glasgow. Electrification will be on the 25 kV 50 c/s overhead system.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the " Electrical Review " clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates do not clash with others already arranged

Monday, 7th May

BIRMINGHAM.—James Watt Institute, Great Charles Street, 6 p.m. I.E.E. South Midland Centre. " Problems of Hydro-Electric Design in Mixed Thermal-Hydro-Electric Systems," by T. G. N. Haldane and P. L. Blackstone.

ILFORD.—Angel Hotel, 8 p.m. A.S.E.E. North-East London Branch. " Heavy Power Units in Dock Installations," by F. W. Sheppard.

LEEDS.—Great Northern Hotel, 7.30 p.m. A.S.E.E. Leeds Branch. " Ultra Violet and Infra Red Lamps," by H. Laycock.

LONDON.—At the Institution of Electrical Engineers, Savoy Place, 5 p.m. Institution of Post Office Electrical Engineers, London Centre. Annual general meeting, followed by " An Introduction to Microwaves and Waveguide Transmission," by C. F. Floyd.

Burlington House, W.1, 5.30 p.m. Society of Engineers. " Oil-Fired Packaged Boilers and Their Development and Application in the United Kingdom," by D. F. Brice.

STAFFORD.—I.E.E. North Staffs. Sub-Centre Graduates' & Students' Section. Annual general meeting, at 7.15 p.m.

Tuesday, 8th May

BELFAST.—Queen's University, 6.30 p.m. I.E.E. Northern Ireland Centre. Annual general meeting, followed by informal talk.

EDINBURGH.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South-East Scotland Sub-Centre. Annual general meeting.

LEEDS.—Sand Moor Golf Club. I.E.E. North Midland Centre. Golf competition.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement & Control Section. " Ship Stabilization: Automatic Controls, Computed and in Practice," by J. Bell.

Connaught Rooms, W.C.2, 12.30 for 1 p.m. Electrical Industries Club lunch.

LUTON.—Midland Hotel, Williamson Street, 8 p.m. A.S.E.E. Luton Branch. Lecturette, by G. C. Morgan.

MANCHESTER. — Engineers' Club, Albert Square, 6.30 p.m. I.E.E. North-Western Graduates' & Students' Section. Annual general meeting, followed by " Copper for the Electrical Industry," by Dr. L. Hodgson and G. H. Park.

College of Technology, 7.30 p.m. Society of Instrument Technology, Manchester Section. Annual general meeting, followed by " Chemical Balances," by Dr. G. F. Hodsman.

Tuesday, 8th May, to Friday, 11th May

HARROGATE. — Illuminating Engineering Society. Summer meeting.

Wednesday, 9th May

BIRMINGHAM.—James Watt Institute, 6.30 p.m. I.E.E. South Midland Graduates' & Students' Section. Annual general meeting, followed by films.

Chamber of Commerce, New Street, 7.15 p.m. A.S.E.E. Birmingham Branch. Film show.

HALIFAX.—Crown Hotel, Horton Street, 7.30 p.m. A.S.E.E. Halifax Branch. " Modern Fire Alarm Equipment," by Mr. Cobham.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Radio & Telecommunication Section. " Time Sharing as a Basis for Electronic Telephone Switching: A Switched Highways System," by L. R. F. Harris.

John Adam Street, W.C.2, 2.30 p.m. Royal Society of Arts. " Automation," by the Earl of Halsbury.

NEWCASTLE-UPON-TYNE. — King's College, 7 p.m. Society of Instrument Technology, Newcastle Section. Annual general meeting.

Wednesday, 9th May, to Saturday, 19th May

LONDON.—Earls Court. Mechanical Handling Exhibition and Convention.

Thursday, 10th May

DUNDEE.—Queen's College, 7 p.m. I.E.E. North Scotland Sub-Centre. Annual general meeting.

LONDON.—Burlington House, W.1, 8.30 p.m. Royal Society. Conversazione.

TORQUAY.—Electric Hall, 3 p.m. I.E.E. South-Western Sub-Centre. " Radio Astronomy," by A. B. Thomas.

Friday, 11th May

BRISTOL.—Grand Hotel, 7.30 p.m. A.S.E.E. Bristol and West of England Branch. Lecture by G. L. Leighton.

LONDON.—Connaught Rooms, W.C.2, 6 for 6.30 p.m. Institution of Engineers-in-Charge. Annual dinner.

Feathers Hotel, Broadway, S.W.1, 6 p.m. Electrical Trades' Commercial Travellers' Association. General meeting.

Friday, 11th May, to Sunday, 13th May

HARROGATE. — I.E.E. Utilization Section. Summer visit.

HASTINGS.—Queen's Hotel. Association of Supervising Electrical Engineers. Annual conference.

SCARBOROUGH. — Spa Theatre. National Industrial Safety Conference.

Friday, 11th May to Monday, 14th May

LLANWRTYD WELLS.—Abernant Lake Hotel. I.E.E. Western Centre. Summer meeting.

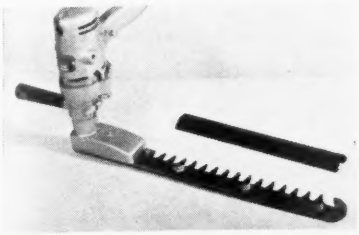
Saturday, 12th May

LEEDS.—The University, 11 a.m. I.E.E. North Midland Centre. Conference on " The Place of Management in Professional Engineering."

NEW ELECTRICAL EQUIPMENT

Hedge Trimmer and Pruner

The newest addition to the range of attachments made by BLACK & DECKER, LTD., Harmondsworth, Middlesex, is designed for pruning and hedge



Black & Decker hedge trimmer and pruning attachment

trimming. It will fit both the ¼in electric "Utility" drill and the sander-polisher drill, and by means of special adaptors can be fitted to most types of ¼in electric drills.

The blade can be swivelled to any position and is locked by a single screw. The total weight of the trimmer attachment and the drill power unit is 7 lb. All the usual shrub plants are easily cut by the trimmer. A widely-spaced hooked tooth is provided at the extreme end of the 13½in blade for pruning. A sheet steel guard slips over the blade to provide complete protection and a firm hand grip, leaving only the pruning hook exposed. Branches up to ⅝in thick can be cut. The price is £5 19s 6d.

Photo-transistor

A germanium photo-transistor has been introduced by MULLARD, LTD., Century House, Shaftesbury Avenue, London, W.C.2. This is designated type OCP71 and is similar in form to a conventional low-power junction transistor.

The photo-transistor can operate successfully from low voltages and can be used in circuits amounting to no more than a connection in series with a relay coil and a 12 V battery. The dark current at 25 deg C is not more than 300 μA and this is quite small compared with the light current which can be of the order of 5-10 mA. The spectral response is peaked in the infra-red region, but continues into the visible light region.

In common with other germanium devices it is not suitable for operation at temperatures above about 40 deg C but will be suitable for most industrial control applications such as counters, speed measurement, burglar alarms, etc. Its small size makes it particularly suitable for tape and punched card reading.

Fluorescent Reflector Lamps

THORN ELECTRICAL INDUSTRIES, LTD., 105-109, Judd Street, London, W.C.1, are marketing new 4ft 40 W and 5ft 80 W "Atlas" fluorescent reflector tubes in white, warm-white and natural at 13s 9d (plus 2s 10d purchase tax) and 14s 9d (3 0½d p.t.). A similar range is announced by EKCO-ENSIGN ELECTRIC, LTD., 45, Essex Street, London, W.C.2.

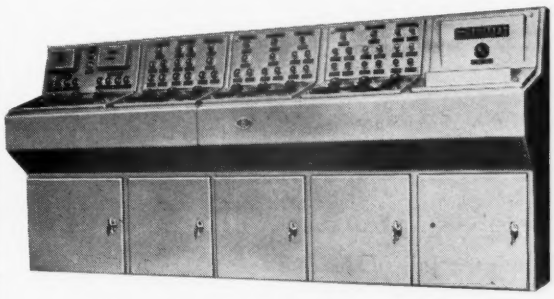
PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2, announce the introduction of a 5ft 80 W warm-white fluorescent reflector lamp at 14s 9d plus 3s 2d purchase tax in the United Kingdom.

The STELLA LAMP CO., LTD., 37-39, Oxford Street, London, W.1, has introduced a similar lamp at the same price.

Control Desks

W. & H. NELSON, LTD., of Mossend, Bellshill, Scotland, are now manufacturing desks for remote electrical control systems for mining and industrial use. In addition to supplying desks to operate in conjunction with their own range of electrical equipment, special units are also being made to customers' specifications.

Left: Mullard OCP71 photo-transistor

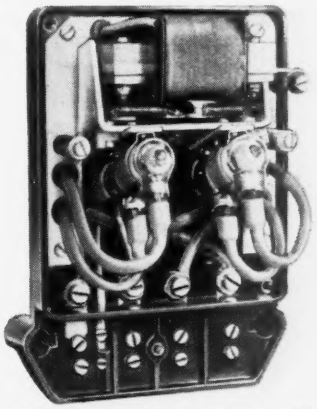


Above: "Nelbest" colliery car handling control desk

Special instruments, switches, etc., can be readily fitted to the detachable or hinged top plates and both back and front panels are removable for easy installation and maintenance. The internal wiring is completed at a terminal board to which all incoming cables are easily connected. Glands for s.w.a. or d.w.a.p.i.l.c. cable, conduit entries, Pyrotenax, and multi-core cable are available.

Mercury Switch Contactors

JOHN BAGGS & CO., Station Road, Uppermill, near Oldham, Lancs, have



Double-pole 30 A Baggs contactor with cover removed

produced a new range of mercury switch contactors available as single, double, triple or multi-pole units for current ratings from 2·5 to 100 A at standard a.c. and d.c. voltages from 25 V a.c. and 6 V d.c.

In all these the coils are vacuum impregnated, suitable for use in damp or tropical conditions; silicone elastomer sleeving is used to insulate the leads, fully flexible from minus 50 to plus 200 deg C. Operation is almost silent.

Heat-flow Meter

A new heat-flow meter developed in Holland is now available in this country from JOYCE SCIENTIFIC INSTRUMENTS, Vine Lane, Northumberland Street, Newcastle-upon-Tyne, 1. This is designed to cover the heat flow through walls of furnaces, drying rooms, cold stores, etc., and can also be used to determine the thermal conductivity of insulating materials. Two sizes are available, the WS31 and WS32, both being supplied calibrated. The meter works by measuring the heat flow through a material of known conductivity and measuring the gradient over the material with thermo-elements.

Both the sizes available are limited in temperature to 160 deg F and give an output of 1 mV from 1·4 B.Th.U/sq ft/hr. Both have a thermal conductivity of 0·15 B.Th.U/deg F/ft/hr. The larger model has a diameter of 4·3in and the smaller one a diameter of 2in.

Financial Section

STOCKS and SHARES

WITH the pre-Budget accumulation of investment business largely dealt with, the industrial markets of the Stock Exchange showed a tendency for both activity and prices to subside. Sentiment was affected by one or two disappointments among the company results for 1955 which are now in flood. Of the giants, I.C.I. and Babcock & Wilcox made a general impression with their decisions to hold the dividends at last year's rates, although the expansion of earnings in both cases reflected well the heavy capital expenditure undertaken by these groups in recent years. For the most part, however, industrial shares lost relatively little of the substantial improvement in their value over the month of April. In the gilt-edged market, where prices had faltered temporarily by reason of the new issue of £250 million British Government stock, the trend became distinctly harder.

Irregular Market

Most of the larger changes in this week's price lists are associated with announcements affecting individual shares. Otherwise, the movements are irregular, with moderate falls tending to predominate. The Babcock & Wilcox earnings figures, however, encouraged other heavy engineering shares. W. H. Allen went higher, and Clarke Chapman again rose to 110s before reacting to 107s 6d. (The official quotation was out of line at 112s 6d.) Other firm features were Electric Construction, H. J. Baldwin and Telegraph Condenser. Anglo Portuguese Telephone put on 1s 9d after news of the good results. B.I.C.C. lost 1s of the improvement produced earlier by the annual figures, and few of the other declines reached dimensions of much importance.

Dividends Maintained

Among the companies recently declaring their final dividends for 1955, Automatic Telephone & Electric, Johnson & Phillips, Ever Ready and L.E.W. are all joining I.C.I. and Babcock & Wilcox in bringing their distributions for the year to the same totals as before. In most instances, the market registered a certain amount of disappointment. In the case of Babcocks, there was evidence of a good deal of speculation in the shares before the announcement, after which the price was marked down from 82s 6d to 78s despite the good earnings figures accompanying it. Group profits expanded by 15 per cent to £4,728,000, after much heavier special depreciation provisions, allowing for which the net surplus still exceeds the amount of the 15 per cent dividend, some 3½ times over. Automatic Telephone's dividend, also of 15 per cent, is covered by a similarly wide margin of earnings, although the latter come out rather lower this time at £785,000 after tax. The £1 shares eased over the week from 67s 6d to 63s 9d.

Ever Ready

As in a good many other recent cases, Ever Ready (Great Britain) 5s

Price Changes in

Company or Board	Nom. Value	Middle price 30th Apr.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1956 Highest	1956 Lowest
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	77½		3	3	3 17 6	80½	75
Brit. Elec. 1974/77	100	76½		3	3	3 18 6	79⅛	73⅜
Brit. Elec. 1976/79	100	81½	+1	3½	3½	4 6 0	84	78⅜
Brit. Elec. 1974/79	100	91½		4½	4½	4 13 0	95	88
Overseas Electric Supply								
Calcutta Elec.	£1	20/-		6†	6†	6 0 0†	20/9	19/-
East African Power	£1	20/9		7	7	6 15 0	21/3	20/-
Nigerian Elec.	£1	20/9		10	10	9 12 9	20/9	17/-
Palestine Elec. "A"	£1	21/-		Nil	Nil	Nil	21/-	21/-
Perak Hydro-Elec.	£1	16/-		10	10	—	17/6	14/9
Equipment and Manufacturing								
Aberdare Cables	5/-	13/6		17½	17½	6 9 9	13/6	10/6
Aerialite	1/-	5/6		88⅛	45*	8 3 6	6/9	5/-
Allen, W. H.	£1	73/9	+3/9	20	20	5 8 6	78/-	67/-
Aron Elec. Ord.	£1	55/9		15	15	5 7 6	56/-	53/6
Assd. Automation	10/-	27/-		10	10	3 14 0	34/9	24/6
Assoc. Elec. Ord.	£1	70/-		14	15	4 5 9	85/6	57/9
Automatic Tel. & El.	£1	63/9	−3/9	15	15	4 14 0	72/6	59/6
Babcock & Wilcox	£1	78/-	−4/6	15	15	3 17 0	85/6	64/-
Baldwin, H.	2/-	4/9	+6d	20	20	8 8 6	5/-	3/9
Bakelite	10/-	29/6	+2/-	16	16	5 8 6	34/-	26/9
Berry's Electric	5/-	6/-		—	10‡	8 6 8	—	—
British Aluminium	£1	52/6	−6d	12	12	4 11 6	53/-	40/6
B.I. Callender's	£1	53/3	−1/-	10	12½	4 14 0	54/3	45/-
B.I. Callender's 6% Pref.	£1	22/-		6	6	5 9 0	22/6	20/3
British Thermostat	5/-	28/9		27½	27½	4 15 0	31/9	24/6
British Vac. Cleaner	5/-	7/3		30	15*	10 7 0	8/9	6/9
Brook Motors	10/-	40/-		20	25	6 5 0	44/-	40/-
Brush Ord.	5/-	7/-		10	10	7 2 9	7/9	6/3
Bulgin, A. F.	1/-	7/3		45	50	6 18 0	7/3	6/6
Burco Dean	5/-	9/6		—	22½	11 16 9	13/3	8/6
Chloride El. Storage "A"	£1	65/-	−2/-	17½	17½	5 7 9	73/6	60/9
Clarke Chapman	£1	112/6	+10/-	20	22½	4 0 0	112/6	89/6
Cole, E. K.	5/-	17/6	−9d	27½	17½*	5 0 0	22/3	16/-
Cossor, A. C.	5/-	8/3	−3d	10	15	9 1 9	10/3	6/9
Crabtree	10/-	28/6		20	20	7 0 3	29/3	27/-
Crompton Parkinson Ord.	5/-	14/9		20	16*	5 8 6	15/-	12/3
De La Rue	5/-	19/6	−3d	20	30	7 13 9	20/3	15/-
Decca	4/-	30/-	−9d	56¼	43¾*	5 16 9	44/9	24/9
Desoutter	5/-	27/3	+9d	25	30	5 10 0	32/9	25/9
Dewhurst	2/-	6/6x.c		24	30	—	6/6	5/3
Dictograph Tel.	2/-	6/3		20	20	6 8 0	6/9	6/-
Dubilier Condenser	1/-	4/3		25	25*	5 17 9	4/6	4/-
E.M.I.	10/-	29/6	−1/-	10	15	5 1 9	37/-	27/-
Electrical Components	5/-	13/9		20	25	9 1 9	16/-	13/9
Elec. Construction	£1	28/9	+1/3	15	8½	5 18 3	29/9	25/-
Enfield Cable Ord.	£1	18/3	+3d	Nil	Nil	Nil	19/3	14/9
English Electric	£1	55/-	−2/6	12½	12½	4 11 0	66/3	47/3
English Electric 3¾% Pref.	£1	13/6	+3d	3¾	3¾	5 11 0	14/6	12/6
Ericsson Tel.	5/-	39/6	−6d	25†	25*†	3 3 3†	42/9	33/6
Ever Ready	5/-	31/-	−1/6	35	35	5 13 0	32/9	24/-
Falk Stadelman	£1	38/9		15	17½	9 0 9	45/9	37/6
G.E.C. Ord.	£1	57/6		12½	14	4 17 3	65/6	50/-
G.E.C. 6½% Pref.	£1	22/9		6½	6½	5 14 3	23/9	21/3
General Cables	5/-	12/9		30	30	11 15 3	13/9	12/9
Greenwood & Batley	£1	46/3		17½	17½	7 11 3	47/6	45/-
Hackbridge Cable	5/-	23/9	−6d	20	25	5 5 3	24/6	18/9
Hackbridge & Hewittic	5/-	18/9	+1/-	25	30	—	22/-	17/3
Heatrae	2/-	4/9		12½	15	6 6 3	5/1	5/-
Henley's	10/-	17/9	+6d	10½	10½	5 18 3	18/3	14/-
Holophane	5/-	17/6		25	30	8 11 6	19/-	17/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend forecast.

shares were run up optimistically in front of the final dividend announcement and let down again after the declaration of a 25 per cent payment, making an unchanged total of 35 per cent for the year ended in early March. The group profit of £1¾ million includes for the first time the contribution from the Continental subsidiaries, and is higher by some £245,000. Apart from these annual results, the shares of the company have been attracting attention lately through the idea that the development of the transistor, in reducing the size of some forms of electronic apparatus to portable weight and dimensions, is likely to create new demands for the dry batteries in which Ever Ready specialises. At a price of 31s (1s 6d lower on the week) the yield on the shares works out at close on 5¾ per cent.

Electrical Investments

Company or Board	Nom. Value	Middle price 30th Apr.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1956 Highest	1956 Lowest
Equipment and Manufacturing—continued								
Hoover	5/-	27/-	−1/-	70	50	9 5 3	39/3	23/-
I.C.I.	£1	48/-	−1/3	10	10	4 3 3	49/9	41/3
Intl. Combustion	5/-	20/6		25	20*	4 17 6	25/-	15/3
Johnson & Phillips	£1	41/6	−3/-	15	15	7 4 6	46/6	37/6
Lancashire Dynamo	£1	45/-		15	11*	4 17 9	49/9	40/9
Laurence, Scott	5/-	16/3		12½	15	4 12 3	16/9	13/3
Lister, R. A.	£1	32/6	+1/3	9·3	10	6 3 0	35/3	27/6
London Elec. Wire	£1	52/6	+3d	12½	12½	4 15 3	52/9	46/6
Lucas, J.	£1	35/-	−9d	7½	7½	4 5 9	40/3	31/3
Marryat & Scott	2/-	10/3	+3d	25	30	5 17 0	11/-	9/6
Mather & Platt	£1	57/-		13·4*	15	5 5 3	65/3	51/6
Metal Industries	£1	17/-	−3d	9	9	—	27/-	16/3
Midland Elec. Mfg.	£1	47/6	+1/3	10	12½	5 5 3	48/6	43/6
Morphy-Richards	4/-	23/3	+9d	35	50	8 12 0	27/3	21/9
Murex	£1	66/3	−9d	15	20	6 0 9	70/3	60/-
Newman Ind.	2/-	2/6		10	10	8 0 0	2/9	2/1
Oldham & Son	1/-	2/6		17½	20	—	3/-	2/4
Parnall (Yate)	5/-	8/-	−6d	14	12	7 10 0	9/6	5/6
Parsons, C.A.	£1	82/6		10	10	2 8 6	85/-	61/6
Plessey	10/-	70/-	−3/9	27½	30†	4 5 9	87/6	56/-
Pye "A" Deferred	5/-	17/6	−1/3	20	12½*	3 11 6	21/3	14/-
Revo	10/-	11/-		9	9	8 3 6	11/9	8/3
Reyrolle	£1	105/-	−2/6	15	16½	3 2 0	110/-	81/-
Rheostatic	4/-	12/9		22½	18½*	—	13/3	12/-
Richardsons Westgarth	5/-	17/-	+1/-	15	16⅔	4 18 0	17/-	13/9
Scottish Cables	4/-	16/9	+1/-	27½	27½	6 11 3	17/6	15/9
Smith (England), S.	4/-	14/-		17½	17½	5 0 0	14/3	11/-
Southern Areas	£1	23/9		7½	10	8 8 6	28/9	21/-
Strand Elec.	5/-	7/9		17½	15*	9 13 6	8/6	7/3
Sturtevant	5/-	26/3	−1/3	14·4†	15†	2 17 3†	31/3	25/3
Sun Elec.	£1	36/-		15	20	11 2 3	37/6	36/-
Switchgear & Cowans	5/-	14/9		20	25	8 9 5	17/-	14/6
Taylor Tunnicliff	5/-	12/3	+3d	15	15	6 2 6	14/-	11/3
T.C.C.	10/-	42/-	+2/-	25	25	5 19 0	43/-	40/6
T.C. & M.	£1	30/6	+6d	8½	8½	5 11 6	34/-	26/-
Telephone Mfg.	5/-	7/-		10	10	7 2 9	8/6	6/3
Thorn Elec.	5/-	19/3	−9d	20	15*	3 18 0	22/6	16/-
Thornycroft	£1	45/-		15	15*	6 13 3	49/9	41/3
Tube Investments	£1	65/-		22½	14*†	4 6 3	70/6	54/9
Vactric	5/-	14/3		10	15*	—	15/-	11/6
Veritys	5/-	8/9	+1/-	12½	12½	7 2 9	10/-	6/9
Walsall Conduits	4/-	12/-		70	70	—	13/6	10/9
Ward & Goldstone	5/-	34/6	+9d	50	30*	4 7 0	38/3	29/-
Watford	2/-	6/9		25	25	—	7/6	6/6
Westinghouse Brake	£1	81/3	+1/3	18	18	4 8 6	100/-	71/6
West, Allen	5/-	14/3	+3d	15	15	5 5 3	14/6	11/6
Wolf Electric	5/-	19/-		20	20	5 5 3	26/3	19/-
Trusts, Transport and Communications								
Anglo-Am. Tel.:								
A. Ord.	100	80	+5	6	6	7 10 0	80	66
Ord.	100	50		3¾	3¾	7 10 0	54	45
Anglo-Portuguese	£1	23/6	+1/9	8	8	6 16 3	23/6	20/3
Brit. Elec. Traction:								
Def. Ord. "A"	5/-	19/-		50	22½*	5 18 6	20/-	15/6
Cable & Wireless:								
Ord.	5/-	11/6	+9d	10	10	4 7 0	11/3	9/6
4% Loan	100	92	+1	4	4	4 7 0	92½	88
Calcutta Trams	£1	23/6		6†	7½†	6 7 9†	26/3	23/-
Cape Elec. Trams	£1	17/6		5½	7½	8 11 6	20/3	18/-
Marconi Marine	£1	31/6		10	10	6 7 0	34/-	31/-
Oriental Tel. Ord.	1/-	78/9	−1/3	16	—	—	90/-	78/-
Telephone Rentals	5/-	11/3	+3d	10	12½	5 11 0	11/9	9/9

J. & P. Capital Plans

At the annual meeting to be held on the 17th of this month, the chairman of Johnson & Phillips expects to make a definite statement on the plans for a new capital issue. Arrangements for the operation, which was foreshadowed last November as necessary for the financing of expanding business, are stated to have reached an advanced stage. This announcement accompanies the publication of the 1955 results, which show that the net group profit, after tax, rose by a quarter to £272,000. Dividend for the year is being maintained at the rate of 15 per cent paid for some years previously. With the capital issue now a near prospect, the £1 shares were marked down by 3s, which is less than the extent of the rise which closely preceded the publication of the results. At 41s 6d they offer a yield of 7½ per cent, without taking into account the value of any rights which may be attached to the intended issue.

More Cable Results

Group earnings of London Electric Wire & Smiths increased last year by more than one-third. Charges for taxation are much higher, but the rise of £100,000, to £625,000 in the net surplus enables the company to maintain very comfortably the 12½ per cent rate of dividend on ordinary capital increased to £2·4 million as a result of the "rights" issue of shares made a year ago. That issue was made to meet the programme for dealing with a constantly rising demand for the company's products, which was thought likely to be augmented by the railway electrification projects, as well as by developments in electronic engineering and atomic power. There was little change in the price of the £1 shares which, at 52s 6d, show a yield of 4¾ per cent from a dividend covered nearly three times by earnings.

Shares on Offer

Bowthorpe (Holdings) 2s shares have been available lately at about 13s 3d to yield 5¼ per cent on the 35 per cent dividend. At the same price, Venner 5s shares give a return of 5¾ per cent, while 5½ per cent is the return from Electrical Apparatus 5s ordinary at 20s 6d. Phœnix Telephone 5s shares yield close on 6¾ per cent at 11s 3d. On Christy Bros. £1 shares at 18s, and on British Electric Resistance 2s shares at 4s 6d, the yields are respectively 7¾ and 8¾ per cent.

REPORTS and DIVIDENDS

Johnson & Phillips, Ltd.—The report and accounts for 1955 show a trading profit of £647,588, as compared with £534,483 for the preceding year, to which is added income from investments of £27,773, transfer fees of £159 and £100,000 transferred from revenue reserve towards abnormal expenditure on reconstruction of buildings and loss of exchange from the devaluation of the Pakistan rupee, making £775,521. After meeting all charges, including £227,000 for taxation, the net profit is £271,521 (against £213,965). General reserve receives £100,000 and it is proposed to pay a final ordinary dividend of 7½ per cent, maintaining the distribution for the year at 15 per cent. The balance carried forward is £147,821 (against £152,136 brought in).

The accounts of the Scottish group (Aurora Lamps, Ltd., incorporating British National Electrics, Ltd.) show a trading profit of £10,561 (against £713).

The report states that negotiations for raising further capital are in an advanced stage, and the chairman expects to be in a position to make a definite statement at the annual meeting on 17th May. Mr. G. Leslie Wates has resigned office as joint managing director, but he remains chairman of the company.

The London Electric Wire Co. & Smiths, Ltd.—The group profit for 1955 is £1,404,067, as compared with £1,035,212 for the preceding year, and after deducting £840,739 for taxation and adding £61,831 adjustments, the net balance is £625,159 (against £525,678). General reserve receives £332,000. The final ordinary dividend is 8¾ per cent, making 12½ per cent for the year (unchanged) on capital increased by a one-in-five rights issue. The balance carried forward is £491,127.

Babcock & Wilcox, Ltd.—The preliminary statement of the financial results for 1955 shows profits of £4,728,418, as compared with £4,104,153 for 1954. Taxation absorbs £2,488,609, and the group net profit is £2,239,809 (against £1,941,342), of which £2,213,748 is attributable to the parent company. To this is added £114,239, tax provisions written back, and sundry capital profits of £70,247. The ordinary dividend for the year is unchanged at 15 per cent with a final payment of 8 per cent.

The Anglo-Portuguese Telephone Co., Ltd.—The preliminary statement for 1955 shows a net profit of £498,155, as compared with £322,538 for 1954. These figures are struck after capital issue expenses of £46,500. It is proposed to place £200,000 to general reserve and to pay a final ordinary dividend of 5 per cent on £3,985,000 capital as increased by a rights issue of £1,000,000, making, with the interim dividend on £2,985,500 capital, 8 per cent for the year. For the previous year a total of 8 per cent was paid on £2,705,000 capital. The dividend on the "A" ordinary capital for the year is maintained at 8 per cent.

The Sturtevant Engineering Co., Ltd., reports group profits of £837,619 for 1955, as compared with £990,361 for the previous year, and after providing £424,825 for taxation, the net balance is £412,794 (against £487,511), to which is added £20,000 unrequired tax provision. General reserve receives £286,813 and it is proposed to pay a final dividend of 12 per cent, making 15 per cent, tax free, for the year. The equivalent distribution for 1954 was 14⅜ per cent when an interim dividend of 5½ per cent was paid on half the present capital and the final dividend of 11⅝ per cent, tax free, was paid on the capital as increased by a one-for-one scrip issue. The balance carried forward is £140,099 (against £127,266 brought in).

The Automatic Telephone & Electric Co., Ltd.—The group profit for 1955 is £1,271,629, as compared with £1,440,400 for the preceding year, and after deducting £512,330 for taxation, the net balance is £785,367 (against £811,523), of which £653,281 is attributable to the parent company. A sum of £394,742 is placed to research reserve, and it is proposed to pay a final ordinary dividend of 12 per cent, maintaining the distribution for the year at 15 per cent. A dividend of 15 per cent for the year is also paid on the "A" and "B" deferred. The group balance carried forward is £890,104 (against £760,045 brought in).

The Ever Ready Co. (Great Britain), Ltd.—The consolidated profits for the year ended 3rd March last are £1,749,743, as compared with £1,504,884 for 1954-55, and after deducting taxation of £871,023 the net profit is £878,720 (against £775,532). The profits of the Continental subsidiaries have been brought into the consolidation for the first time this year and are reflected in this year's figures. The dividend for the year is maintained at 35 per cent by a final payment of 25 per cent.

Cable & Wireless (Holding), Ltd., has announced a first interim dividend of 2½ per cent (against 4⅛ per cent) on larger capital.

The Power Investment Corporation, Ltd., reports a net revenue for 1955-56 of £53,305, as compared with £39,619 for 1954-55. It is proposed to pay a dividend for the year of 8 per cent (against 5 per cent).

New Companies

W. E. Partridge (Electrical), Ltd.—Registered 28th February. Capital £2,500. To acquire the business of electrical contractors and retailers of radio and television goods hitherto carried on at 111a, High Street, Wordsley, Staffs, as "W. E. Partridge." Directors: W. E. Partridge and Mrs. Valerie M. Partridge (secretary). Regd. office: 111a, High Street, Wordsley, Staffs.

Tranduct, Ltd.—Registered 13th March. Capital £100. Manufacturers of electrical trunking and ducting and other electrical equipment and utensils, etc. Directors: J. P. Dennis and H. P. Dennis. Regd. office: 56, Whitechapel, Liverpool, 1.

J. & P. A. Smith, Ltd.—Registered 7th February. Capital £100. Electrical engineers and contractors, electricians, radio engineers, electrical wiring contractors and specialists, etc. J. Smith is the first director. Regd. office: Eldon Chambers, Wheeler Gate, Nottingham.

Barrowford Relay Services, Ltd.—Registered 8th February. Capital £1,000. Electrical engineers and general electrical installation contractors, radio and television engineers and service agents, etc. Directors: Mrs. Lilian Catlow, A. Plunkett and R. Plunkett. Solicitors: Pollard Bower & Co., Burnley.

H. M. Horton Holdings, Ltd.—Registered 8th February. Capital £500. Electrical, radio, television and refrigeration engineers and contractors, etc. Directors: H. M. Horton, and L. S. Brace. Regd. office: 16, Manchester Square, W.1.

W. G. Heath & Co., Ltd.—Registered 3rd February. Capital £40,000. To acquire the business of an electrical and mechanical engineer and contractor, refrigeration engineer and dealer in electrical goods and television and radio equipment carried on by W. G. Heath at Plymouth, as W. G. Heath & Co., etc. Directors: W. G. Heath, Miss Helena D. H. Heath, B.Sc., P. S. Heath and W. D. Worth. Red. office: 5, Princess Square, Plymouth.

Trembath & Co. (Wholesale), Ltd.—Registered 27th January. Capital £1,000. Wholesale distributors of refrigerators and electrical appliances of all kinds, etc. Directors: N. L. Trembath, Mrs. Barbara M. Trembath and A. M. Watson. Regd. office: 46/50, Streatham Hill, S.W.2.

Denpa (Electrical), Ltd.—Registered 22nd February. Capital £100. Electrical engineers and contractors, manufacturers and repairers of and dealers in radio, electrical and mechanical apparatus, etc. Directors: D. N. Crozier and Pamela G. Crozier. Regd. office: 223, Deansbrook Road, Burnt Oak, Edgware, Mdx.

Finch Wholesale Electrics, Ltd.—Registered 21st February. Capital £1,000. Directors: Sir Roger P. Hawkey, Bt., L. J. Rice and A. L. Prickett. Regd. office: 544, Ley Street, Ilford, Essex.

Trevelec, Ltd.—Registered 21st February. Capital £100. Electrical engineers and contractors, radio and television engineers, etc. Directors: J. T. Jones and Mrs. Dorothy A. Jones. Regd. office: 58, Glendyke Road, Allerton, Liverpool, 18.

F. H. Russell, Ltd.—Registered 11th February. Capital £1,000. Electrical engineers, etc. Directors: F. H. Russell and Mrs. Marie E. Russell. Regd. office: 141, Staines Road, Hounslow, Mdx.

Liquidation

The Northern Electrical Co. (Grimsby), Ltd.—Winding up voluntarily. Liquidator, Mr. L. F. McCulloch, 26, South St. Mary's Gate, Grimsby, appointed 16th April. Particulars of claims to the liquidator by 2nd June.

Bankruptcies

K. R. Clover, carrying on business as K. R. Clover & Co., at 3, Market Cross, Sturminster, Newton, Dorset, radio and electrical engineer. —Receiving order made 18th April on debtor's own petition. Public examination 13th July at the County Hall, Dorchester.

H. Smith, lately carrying on business as an electrical engineer at The Old Bakery, South Clifton, Nottingham.—Receiving order made 18th April on a creditor's petition.

H. W. Daldry, lately carrying on business at 168, Bells Road, Gorleston-on-Sea, electrician. —Application for discharge to be heard on 7th June at the Town Hall, Great Yarmouth.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 0d each including postage) will be obtainable after 9th May from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1950

23879. Standard Telephones & Cables, Ltd.—Automatic telephone systems. 29th September, 1950. (748752.)

23950. British Broadcasting Corporation. —Television cameras. 1st October, 1951. (748821.)

1951

20977. C.W.C. Equipment, Ltd., and Bridle, K. F.—Lever operated electric switches. 22nd August, 1952. (748691.)

1952

2199. British Broadcasting Corporation. —Electronic switches comprising electron discharge tubes. 19th December, 1952. (748822.)

8914. National Research Development Corporation.—Circuits using cold cathode scaling tubes. 7th April, 1953. (748761.)

10071. Prinke, B.—Supply of heat from district heating systems having a source of heat such as a power station or heating station. 22nd April, 1952. (748595.)

29476. Licentia Patent-Verwaltungs Ges. —Feeding a d.c. motor from a.c. mains through a grid-controlled rectifier. 21st November, 1952. (748766.)

29778. Ohmart Corporation.—Method of converting ionic energy into electrical energy. 25th November, 1952. (748598.)

30793. Clang, Ltd., and Harwood, C. D. —Electromagnetic switches. 22nd March, 1954. (748698.)

1953

6063. Ridley, N.—Apparatus for generating power from solar heat. 25th February, 1954. (748700.)

7503. General Electric Co., Ltd., and Rollin, L.—Piezo-electric quartz crystal vibrators. 18th June, 1954. (748649.)

9705. General Electric Co., Ltd., and Connell, L. J. C.—Heater panels. 9th March, 1954. (748650.)

10726. National Research Development Corporation.—Electrical binary-digital pulse signalling systems. 13th April, 1954. (748771.)

11633. Leclabart, J., and Hiltenbrand, C. —Hair driers. 27th April, 1953. (748606.)

12465. British Thomson-Houston Co., Ltd.—Electric motor control systems. 5th May, 1954. (748705.)

13190. Electric & Musical Industries, Ltd.—Wired electrical signal distributing systems. 7th May, 1954. (748776.)

13876. English Electric Co., Ltd.— Dynamo-electric machines. 14th May, 1954. (748826.)

14193. Celestin, W. E.—Electron camera tubes for stereoscopic television. 21st July, 1954. (748778.)

14203. Metropolitan-Vickers Electrical Co., Ltd.—Mine hoists and like winding gear. 19th May, 1954. (748707.)

15826. Siemens Bros. & Co., Ltd.—Automatic telephone systems. 4th June, 1954. (748655.)

15874. Socony Mobil Oil Co., Inc.— Apparatus for displaying and re-recording reproducible records of transient waveforms. 9th June, 1953. (748782.)

16229. General Electric Co., Ltd., and Fairbairn, E. P.—Telecommunication systems. 2nd June, 1954. (748783.)

16465. Smith, J. R.—Electric driving means. 15th September, 1954. (748708.)

19065. Licentia Patent-Verwaltungs-Ges. —Heavy current mechanical contact rectifier. 9th July, 1953. (748711.)

19855. General Electric Co., Ltd., and McKeag, A. H.—Electric discharge lamps. 12th July, 1954. (748788.)

19965. Simplex Electric Co., Ltd.—Cooking stoves. 15th July, 1954. (748614.)

20570. Westinghouse Brake & Signal Co., Ltd., and Wheatley, J. D.—Rectifier sets for supplying intermittent overload currents. 9th July, 1954. (748713.)

21070. Garrard Engineering & Manufacturing Co., Ltd.—Piezo electric pickups. 23rd July, 1954. (748659.)

22675. Soc. d'Eléctronique et d'Automatisme.—Electric multiplying devices. 17th August, 1953. (748802.)

23320. British Transport Commission, and Dell, R.—Signal operating systems controlled by the speed of moving vehicles, particularly trains. 16th June, 1954. (748807.)

23871. Sylvania Electric Products, Inc.— Electroluminescent display systems. 28th August, 1953. (748834.)

23872. British Insulated Callender's Cables, Ltd.—Electric protective arrangement for use with capacitors. 27th August, 1954. (748716.)

24272. Clang, Ltd., and Harwood, C. D.— Terminals of the slotted type for electric conductors. 22nd June, 1954. (748837.)

24727. Oldham & Son, Ltd., and Prout, L. R.—Manufacture of electrical storage batteries. 6th September, 1954. (748719.)

25233. Vickers-Armstrongs (Engineers), Ltd.—Slide wire potentiometers. 13th August, 1954. (748666.)

26121. British Thomson-Houston Co., Ltd.—Regulators for Ward-Leonard system. 22nd September, 1954. (748841.)

26299. Standard Telephones & Cables, Ltd.—Electric pulse communication systems. 24th September, 1953. (748809.)

26340. Philips Electrical Industries, Ltd. —Amplifier circuit arrangements. 24th September, 1953. (748668.)

26595. General Electric Co., Ltd., and Beesley, J. H.—Electrical signal gating circuits. 17th September, 1954. (748810.)

26971. Communications Patents, Ltd.— Radar simulating apparatus. 21st September, 1954. (748623.)

27239. General Electric Co., Ltd., and Beesley, J. H.—Electrical gas discharge tube circuits. 24th September, 1954. (748791.)

28831. Ericsson Telefoon-Maatschappij N.V.—Circuit arrangement for identifying and retaining data that discriminate a conductor with respect to other conductors of a system. 19th October, 1953. (748793.)

28950. General Electric Co.—Semi-conductor devices. 20th October, 1953. (748845.)

30047. Siemens-Schuckertwerke Akt.-Ges.—Thermo-couples. 30th October, 1953. (748847.)

30509. Standard Telephones & Cables, Ltd.—Electrical signal translating equipment. 4th November, 1953. (748730.)

31429. Standard Telephones & Cables, Ltd.—Radio communication systems. 5th November, 1954. (748736.)

31753. Infra Red Development Co., Ltd. —Electronic restoring circuits. 16th November, 1954. (748671.)

32205. Bridle, K. F.—Safety switches for rack-mounted electrical equipment. 3rd February, 1955. (748672.)

32431. Electro Manganese Corporation. —Anodes for the electro-winning of manganese. 23rd November, 1953. (748630.)

32860. Siemens-Schuckertwerke Akt.-Ges.—Electrical circuits including semi-conductor devices. 26th November, 1953. (748799.)

33241. British Thomson-Houston Co., Ltd.—Speed control of d.c. motors. 30th November, 1953. (748853.)

33461. Allmanna Svenska Elektriska Aktiebolaget.—Electro selector device. 2nd December, 1953. (748800.)

34011. Welwyn Electrical Laboratories, Ltd., and Browning, J.—Electrical resistors. 15th October, 1954. (748674.)

34137. Saunders, A. H.—Electrical test probes. 2nd September, 1954. (748811.)

34259. Imperial Chemical Industries, Ltd.—Production of electric fuseheads. 11th October, 1954. (748675.)

36058. Lampe Norma-Soc. Auto Lampe. —Combination of an incandescent lamp and a reflector, more particularly for car lighting. 29th December, 1953. (748740.)

1954

5398. Pirelli-General Cable Works, Ltd., and Ashton, A. L.—Oil-filled electric cables. 24th November, 1954. (748678.)

5978. Stamicarbon N.V.—Electric motor and coupling units. 1st March, 1954. (748679.) 6285. Electric motor. 3rd March, 1954. (748680.)

10095. British Thomson-Houston Co., Ltd.—Electroluminescent devices. 6th April, 1954. (748683.)

27266. Standard Telephones & Cables, Ltd.—Rectifier switch circuits. 21st September, 1954. (748746.)

1955

3088. C.W.C. Equipment, Ltd., and Bridle, K. F.—Lever operated electric switches. 22nd August, 1952. (748748.)

7950. Standard Telephones & Cables, Ltd.—Electric motor controlling equipment. 18th March, 1955. (748690.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 18th May:—

ERMA-BURNDY. No. 748,376. Class 9. Electric connectors and electric terminals.— Erma, Ltd., Hong Kong Works, Exhibition Grounds, Wembley, Middx.

No. 748,091 (design). Class 9. Electrical apparatus and instruments; scientific, nautical, surveying, radio, television, photographic, cinematographic, optical, weighing, measuring, checking (supervision), life saving and teaching apparatus and instruments; electrical apparatus incorporating automatic mechanisms for use in making hot beverages; electric heating elements; electrically-heated irons; and domestic electric utensils.—L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, Kingsway, London, W.C.2.

No. 748,571 (design). Class 9. Electrical apparatus and instruments; scientific and signalling apparatus and instruments; talking machines; and electric coils.—Rendar Instruments, Ltd., All Hallows Works, Park Lane, Tottenham, London, N.17.

STERLING (design). No. 748,946. Class 9. Telephone cables.—Sterling Cable Co., Ltd., Aldermaston, Berks.

IRRAYDOL. No. 749,245. Class 9. Electrical instruments and apparatus; and covered electric wire and electric cables.—Wandleside Cable Works, Ltd., 106, Garratt Lane, Wandsworth, London, S.W.18.

FIREFLY. No. 746,055. Class 11. Electric fires and parts.—Allied Ironfounders, Ltd., 28, Brook Street, London, W.1.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Anglesey.—6th June. Education Committee. Electrical installation in Llanfawr new county primary school, Holyhead. (See this issue.)

Australia.—21st June. Sydney County Council. 11,000 V, 150 MVA metalclad switchgear for substations. (E.S.B. 11093/56. Ten/19113.)*

19th June. Snowy Mountains Hydro-Electric Authority. Protective equipment for T.1 power station. (E.S.B. 10529/56. Ten/19101.)*

26th June. Public Works Department, Perth. Pumping machinery and control gear. (E.S.B. 10585/56. Ten/19090.)*

18th July. Victorian Railways. P.A.B.X. equipment, telephone switchboard and telephones. (E.S.B. 10602/56. Ten/19070.)*

Burma.—14th May. Union Purchase Board. Electric light sockets and brackets. (E.S.B. 10724/56. Ten/19036.)* 288 splitter switches. (E.S.B. 10722/56. Ten/19038.)* 15th May. 544 electric fans. (E.S.B. 10718/56. Ten/19039.)*

Canada.—17th May. Manitoba Hydro-Electric Board. Main control switchboards for Brandon generating station. (E.S.B. 10448/56. Ten/19072.)*

Carlisle.—22nd May. City Council. Electrical installations in four shops and flats on the Harraby estate. L. J. A. Stow, city engineer, 18, Fisher Street.

Croydon.—11th May. Borough Council. Street lighting equipment. (See this issue.)

Dorking.—25th May. U.D.C. Re-wiring in Dorking Halls. (See this issue.)

Formosa.—29th May. Central Trust of China, Purchasing Department. Radio and electrical apparatus. (E.S.B. 11080/56.I.C.A. Ten/19106.)*

French Guinea.—Energie Eléctrique de Guinée. Construction of barrage and underground power station at Souapiti. (E.S.B. 9778/56. Ten/19088.)*

India.—15th May. West Bengal State Electricity Board. 150 50-1,000 kVA power and distribution transformers. (E.S.B. 10563/56. Ten/19021.)*

16th May. Bombay Electricity Board. Three 4,000 kVA transformers. (E.S.B. 10746/56. Ten/19057.)*

22nd May. Director General of Supplies and Disposals. Insulated cable. (E.S.B. 11205/56. Ten/19111.)* 5th June. H.v. paper insulated cable. (E.S.B. 11209/56. Ten/19115.)*

6th June. Kanpur Electricity Supply Administration. Six 100-4,000 kVA transformers. (E.S.B. 10863/56. Ten/19055.)*

9th July. Calcutta Electrification Project, Eastern Railways. Substation, track cabin and supervisory control equipment. (E.S.B. 10911/56. Ten/19081.)*

16th July. Damodar Valley Corporation Electricity Department. Steam generators, fans, dust collectors, air preheaters, combustion control equipment, feed pumps and accessories. (E.S.B. 10861/56. Ten/19082.)*

Iraq.—15th May. Directorate General of Municipalities. Two 10 kW diesel driven alternator sets for Yousufia. (E.S.B. 10565/56. Ten/19019.)* 16th May. 250 kW generating set for Erbil. (E.S.B. 10566/56. Ten/19025.)*

Middlesbrough.—11th May. Borough Council. Electric lamps and unit dry cells for the year ending 30th June, 1957. Borough engineer, Municipal Buildings.

New Zealand.—31st May. General Post Office. 22,500 switchboard lamps. (E.S.B. 10458/56. Ten/19042.)* 1st June. Telephone cable. (E.S.B. 10460/56. Ten/19043.)*

17th July. State Hydro-Electric Department. Eight transformer banks and spare units. (E.S.B. 10459/56. Ten/19054.)*

Pakistan.—23rd May. Posts and Telegraphs Department. Porcelain insulators. (E.S.B. 10843/56. Ten/19058.)*

South Africa.—25th May. Stores Department, South African Railways. Six 6·6 kV switchboards. (E.S.B. 10933/56. Ten/19074.)*

Southern Rhodesia.—30th May. Municipality of Umtali. 250 MVA, 11 kV ring main switchgear. (E.S.B. 10635/56. Ten/19052.)* 250 MVA, 11 kV ring main fusegear. (E.S.B. 10637/56. Ten/19050.)* 250 MVA, 11 kV switchboard. (E.S.B. 10638/56. Ten/19049.)* 31 distributor transformers. (E.S.B. 10636/56. Ten/19051.)* 11 kV armoured cable. (E.S.B. 10634/56. Ten/19046.)*

Syria.—9th May. Ministry of National Defence, Damascus. Switches, terminal boxes, lamp-posts and underground armoured cables. (E.S.B. 10571/56. Ten/19027.)*

United States.—15th May. Bureau of Reclamation. Eight motor-driven pumping units. (E.S.B. 10760/56. Ten/19056.)*

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Barrow-in-Furness.—Works, Sandscale, for British Cellophane, Ltd.; Melville, Dundas & Whitson, Ltd., contractors, 21, Blythswood Square, Glasgow.

Barry.—Shops (20) with maisonnettes at Colcot site; borough surveyor, Town Hall, Holton Road, Barry, Glam.

Billingham (Co. Durham).—Houses (307), Roseberry Road estate; J. H. Shepherd, U.D.C. surveyor.

Birmingham.—Houses (191), Wyrley Birch estate, Erdington; A. G. Sheppard Fidler, city architect, Civic Centre, 1.

Bourne.—County secondary school; Rudd & Son, Ltd., builders, Wharf Road, Grantham.

Bromsgrove.—College of further education on site off Well Lane, for Worcestershire E.C.; F. R. S. Yorke, E. Rosenberg and C. S. Mardall, architects, 2, Hyde Park Place, London, W.2.

Bury.—Dwellings (80) at Huntley Fold Site No. 4; A. Spencer, 31, Bold Street, Accrington.

Carlisle.—Houses (250); L. J. A. Stow, city engineer, 18, Fisher Street.

Cartmel.—Cartmel Priory secondary school; Thompson & Jackson, Ltd., Moor Lane, Lancaster.

Chesterfield.—Houses and flats (52) near Swanwick Memorial Hall (£61,609) and houses (86) on Whitecotes Farm estate (£108,971); borough surveyor.

Chorley.—R.C. School of St. Augustine; Weightman & Bullen, architects, 76, Rodney Street, Liverpool.

Crawley.—Additional wing to hospital; Yorke, Rosenberg & Mardall, architects, 2, Hyde Park Place, London, W.2.

Darlington.—Secondary county school (£225,216); borough architect.

Doncaster.—Sycamore primary schools (£118,200); borough architect.

Dover.—Flats (222), Marine Parade; Dalgliesh & Pullen, architects, 17, Fitzhardinge Street, London, W.1.

Houses (40), on several sites; borough surveyor, Brook House.

Dudley.—Extensions to Dudley & Staffs. Training College (£50,000); F. H. Gibbons, borough surveyor, Council House.

Easington.—Pavilion at Grindon Park (£80,000); R.D.C. surveyor.

East Barnet.—Houses (38) (contracts 812 and 813); U.D.C. surveyor, Town Hall, Station Road, New Barnet, Herts.

Evesham.—Houses (50), Bretforton, Cow Honeybourne and Cleeve Prior; R.D.C. surveyor, Council Offices, Lansdowne, Port Street.

Fareham.—Houses (204), Hillson Drive area; surveyor, Westbury Manor, Fareham, Hants.

Frome.—Shops and flats, Rodden estate; G. Wheeler, architect, 26, Nunney Road.

Guildford.—Houses (63); J. W. Wilton, R.D.C. surveyor, Millmead House.

Loughborough.—Houses (100) with community buildings, on Ashby Road Estate; borough architect.

Newport (I.O.W.).—75-bed unit at Whitecroft Hospital (£130,507), for South West Metropolitan Regional Hospital Board; architect to the Board, 76, Wimpole Street, London, W.1.

Northallerton.—County school (£151,000); school at Catterick Camp (£41,000); extensions to grammar school at Richmond (£60,000); and second stages of grammar schools at Stokesley (£62,000) and Thirsk (£150,000); county architect, Northallerton.

Oldham. — Houses (91), Alt estate; Cameron & Middleton, quantity surveyors, 21, Queen Street, Oldham.

Ponteland (Northumberland).—C. of E. secondary school; Newcombe & Newcombe, architects, 23, Eldon Square, Newcastle-on-Tyne.

Romford.—Flats (42), Romside and Fairview; J. Twinn, town clerk, Town Hall.

Rowley Regis.—Houses (70), Corngreaves estate; architect, Municipal Buildings, Old Hill, Staffs.

Smethwick.—Aged persons' home at Hill Crest; C. Green & Sons, Ltd., 132, Monument Road, Edgbaston, Birmingham.

Sunderland.—Shops (25), Hylton Red House estate, for Ravenseft Properties, Ltd., London; L. H. Fewster & Partners, architects, 22, Conduit Street, London, W.1.

Taunton.—Teaching block for Queen's College; R. G. Spiller, Ltd., builders, High Street, Chard.

Thornaby-on-Tees. — Three-storey flats, George Street; J. L. Watson, borough engineer.

Tipton.—Dwellings (144) at Princes End site; Rock & Downes, Ltd., 115, Walsall Road, Aldridge, Staffs.

Tynemouth.—Houses (36), Redburn View; borough engineer, 16, Northumberland Square, North Shields.

Wakefield.—Proposed eight-storey blocks of flats at George Street site; borough engineer.

Wallsend.—Secondary school, Low Willington (£184,475); county architect, County Hall, Newcastle.

Extensions to Civic Hall (£20,000); T. Clements & Sons, Selborne Gardens, Newcastle.

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* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).